Capital Improvement Program

FY99-01

Project Binder

MASSACHUSETTS WATER RESOURCES AUTHORITY

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CAPITAL IMPROVEMENT PROGRAM

FISCAL YEARS 1999-2001

October 1998

Prepared under the direction of

Douglas B. MacDonald, Executive Director
Barbara Gottschalk, Director, Finance Division

by the Rates and Budget Department

Ronald M. Joseph, Director

With the participation of staff from the Program Management Division,
Sewerage Division, Waterworks Division, Support Services Division,
and Engineering and Construction Department.

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GUIDE TO READING THE BUDGET DOCUMENTS

The MWRA CIP is presented in two documents:

Budget Document

Includes an Executive Summary which presents anticipated capital spending for the next ten years by program area, anticipated grant revenue and capital funding requirements needed to support the capital program, and the impact of operating new facilities on the Current Expense Budget (CEB). The Executive Summary also includes an overview of 100-year actual and planned spending for wastewater and waterworks improvements. In addition, the budget document presents individual project summaries describing project status, changes in scope, explanations of budget and schedule changes since the previous budget, and operational impacts. Expenditure Forecast tables include detailed schedule, budget, spending to date, and ten-year annual planned spending by program, program category, project, and subphase (contracts). The Budget Document is published twice a year, for the proposed and final budgets.

Project Binder (this report)

Includes an overview section followed by individual project summaries describing the purpose, history and background, detailed scope information by subphase, and maps. The Project Binder is published once a year.

Summary

Refer to the **Budget Document** for financial, budget, and schedule information. Refer to the **Project Binder** for project descriptions, including the scopes of individual subphases.

Overview

What is the Massachusetts Water Resources Authority?

The Massachusetts Water Resources Authority (MWRA) is a quasi-public agency created by the Commonwealth of Massachusetts in 1985, with the responsibility for providing water service to 47 cities and towns, and collection and treatment of sewerage from 43 cities and towns. MWRA operates and maintains waterworks and wastewater facilities located from the Quabbin Reservoir in western Massachusetts to Boston Harbor.

Mission

MWRA's mission is to provide reliable, cost-effective, high quality water and sewer services that protect public health, promote environmental stewardship, maintain customer confidence, and support a prosperous economy.

Wastewater and Waterworks Systems History

MWRA inherited the wastewater and waterworks systems from the Metropolitan District Commission, an agency that did not possess the institutional and financial ability to maintain reliable service and meet modern environmental regulatory requirements. MWRA inherited a backlog of scores of projects, at a projected cost of more than $1 billion, that addressed only immediate service delivery problems. In addition, MWRA assumed the formidable task of eliminating wastewater pollution in Boston Harbor by constructing a new primary and secondary treatment plant on Deer Island.

Since 1985, MWRA has made significant progress in addressing these problems. MWRA is also now moving ahead on several major waterworks transmission, distribution, and treatment projects designed to ensure that it will continue to reliably transport water from the Quabbin and Wachusett Reservoirs to the distribution reservoirs in western metropolitan Boston, and that this water will be treated and stored to maintain its high quality and meet federal safe drinking water requirements. These projects include the MetroWest Tunnel, the Walnut Hill Water Treatment Plant, and construction of several covered storage distribution facilities.

WASTEWATER SYSTEM IMPROVEMENTS

Overview

Wastewater System Improvement projects continue modernization of the wastewater collection system to meet current and future demand, and to improve the level of wastewater treatment.

Program Categories

MWRA divides Wastewater System Improvements into five categories: Interception and Pumping, Treatment, Residuals Management, Combined Sewer Overflows (CSOs), and Other.

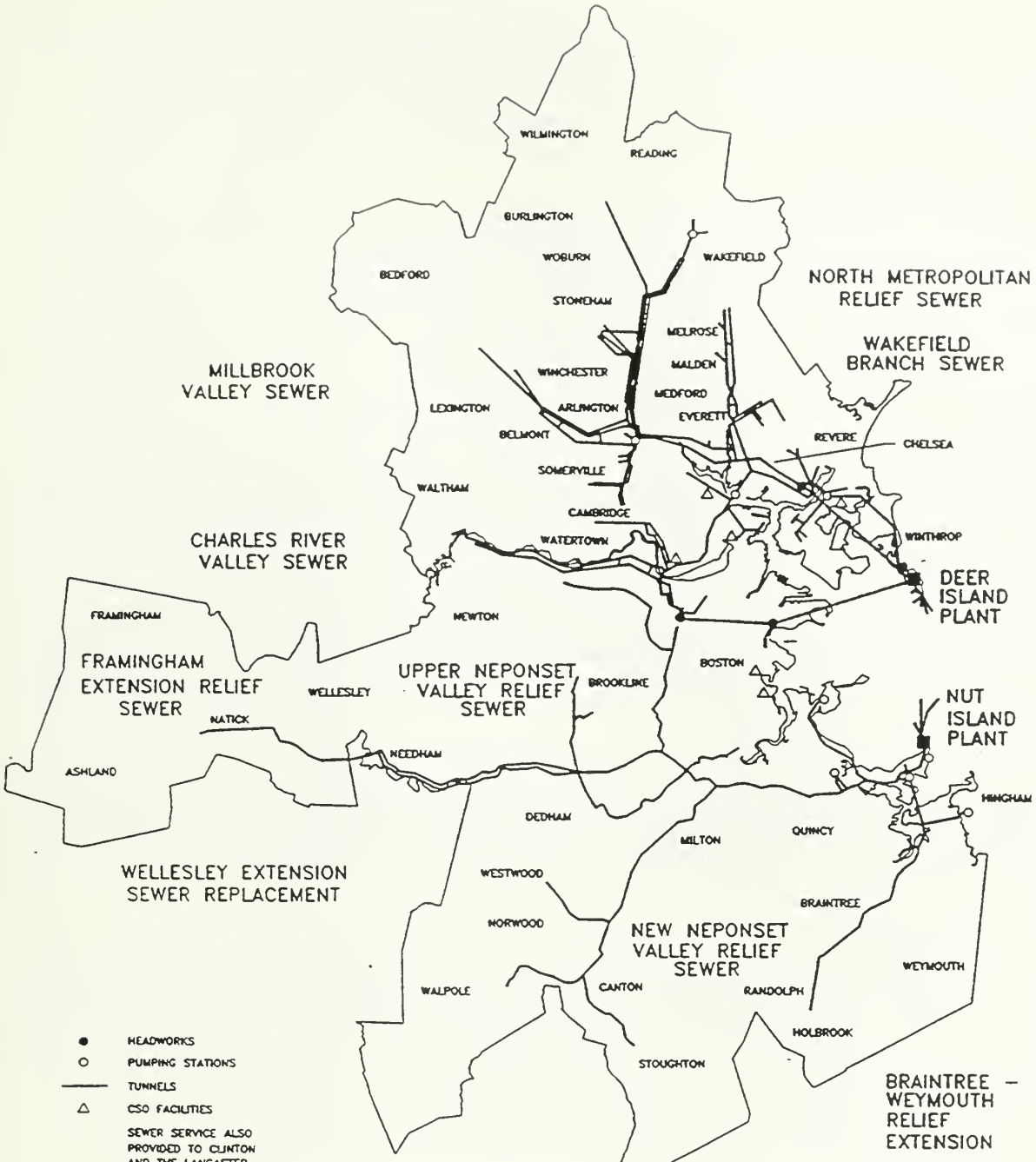
Interception and Pumping

The Interception and Pumping category includes 17 projects to improve the sewage collection and pumping system at an estimated cost of $432 million. MWRA is constructing or plans to construct five new relief and replacement interceptor sewers in the southern collection system at a cost of $311.4 million. These interceptor projects include installation of approximately 56 miles of pipeline, gravity sewers, and siphons; construction of three new pump stations; and construction of a 2.9 mile deep rock tunnel. The $30.4 million New Neponset Valley Relief Sewer project achieved substantial completion in September 1996, and the last component of the $48 million Framingham Extension Relief Sewer project will be complete in 2001. MWRA expects to complete the final $71.6 million phase of the Wellesley Extension Sewer Replacement project in 2004, and Braintree-Weymouth Relief Facilities in 2004.

The Interception and Pumping category also includes three pump station rehabilitation projects in Quincy. The existing stations are from 50 to 85 years old, cannot handle existing sewage flows, and need substantial equipment rehabilitation. MWRA will complete the $20.2 million Quincy Pump Facilities project in 2001.

In the northern collection system, MWRA plans to complete rehabilitation of the North Metropolitan Trunk Sewer in 1999 at a cost of $13.5 million. In addition, the Cummingsville Replacement Sewer project will address sewerage surcharging and overflow problems. The projected completion date for the $5 million Cummingsville project is 2002.

Many siphon chambers and diversion structures in the wastewater system are inaccessible for maintenance, resulting in debris accumulation, poor flow conditions, and serious odor problems. The CIP includes a $6 million project to inspect all structures and identify methods to improve accessibility and the transport of flows. MWRA plans to complete facilities planning for this project in 1998.



MWRA SEWERAGE SYSTEM

The FY99-01 CIP includes one new Interception and Pumping project. Completion of the $350,000 Archdale Road Diversion Structure project will permit diversion of up to 150 million gallons per day to mitigate potential overflows.

Wastewater Treatment

The Treatment category includes MWRA's most significant wastewater project, the federal court mandated Boston Harbor Project (BHP). The primary component of the BHP is the new Deer Island Primary and Secondary Treatment Plant (DITP). When complete the new plant will have the capacity to process 1.27 billion gallons of wastewater per day (bgd) for primary treatment and 1.08 bgd for secondary treatment. Construction of the plant and related facilities is an 11-year endeavor and will cost approximately $3.7 billion, including off-island residuals management facilities. The new Deer Island plant will be the second largest treatment plant in the United States. (A more detailed discussion of the plant is found later in this document.) The new plant replaces two existing primary plants: the Deer Island plant, built in 1968, and the Nut Island plant, built in 1952. The first phase of the new plant began operation in January 1995. The first phase of secondary treatment began in August 1997.

The Wastewater Treatment category also includes eight projects to rehabilitate existing facilities and maintain the Deer Island plant. One project, begun in 1987, consists of improvements to the three Deer Island headworks facilities. Remote Headworks Rehabilitation is projected for completion in 1999 at a total cost of $3.3 million.

This program category also includes a $35 million project for Deer Island Equipment Replacement to support an initial ten-year replacement cycle for maintenance intensive components of the DITP which have a useful life of ten to 25 years.

Residuals Management

The new Deer Island Treatment Plant requires residuals management facilities, on and off Deer Island, to effectively treat and dispose of treatment by-products. Total off-island residuals management capital cost estimates are $160 million, including $97.3 million for the initial construction of the sludge pelletizing plant at the Fore River Staging Area in Quincy. Operation of the plant began in December 1991. This budget includes $53.3 million for plant expansion to accommodate increased sludge volume generated by the new secondary treatment facilities at Deer Island.

This program category includes two new projects:

- Pelletizing Plant Cogeneration Facility, a $6.8 million project to construct a cogeneration facility at the plant in Quincy which will use natural gas to produce hot air for dryers and electricity to meet the power needs of the plant. The facility is expected to reduce energy costs and provide significant annual savings.

- Pelletizing Plant Natural Gas Pipeline, a $2.2 million project to construct a natural gas pipeline to the plant. Construction of the pipeline will allow MWRA to avoid a Boston Gas distribution change currently assessed as part of supply charges, resulting in potential annual savings of $250,000.

Combined Sewer Overflows

The Wastewater System Improvements program area also includes a region-wide facilities plan and portfolio of construction projects to manage and control solutions for combined sewer overflows (CSOs). Planning, design, and construction of region-wide CSO control facilities are estimated to cost $491.2 million. The new plan, differs markedly from the 1990 recommendation to construct a series of holding tunnels, calls for the construction of 24 local projects to address the different water quality needs of the various receiving water segments in Boston Harbor and its tributaries.

Other Wastewater Projects

The Infiltration/Inflow (I/I) Local Financial Assistance Program provides financial incentives to communities to rehabilitate their collection systems to structurally reduce I/I flows. The FY99-01 CIP includes an additional $37 million for Phase III of the program. The new fund will be allocated to member communities at a 45 percent grant/55 percent loan ratio.

This program category also includes one new project, Sewerage System Mapping Upgrade, to enhance the accuracy of existing and newly created GIS maps of sewerage communities. The project will help improve responsiveness to emergencies in the transport system.

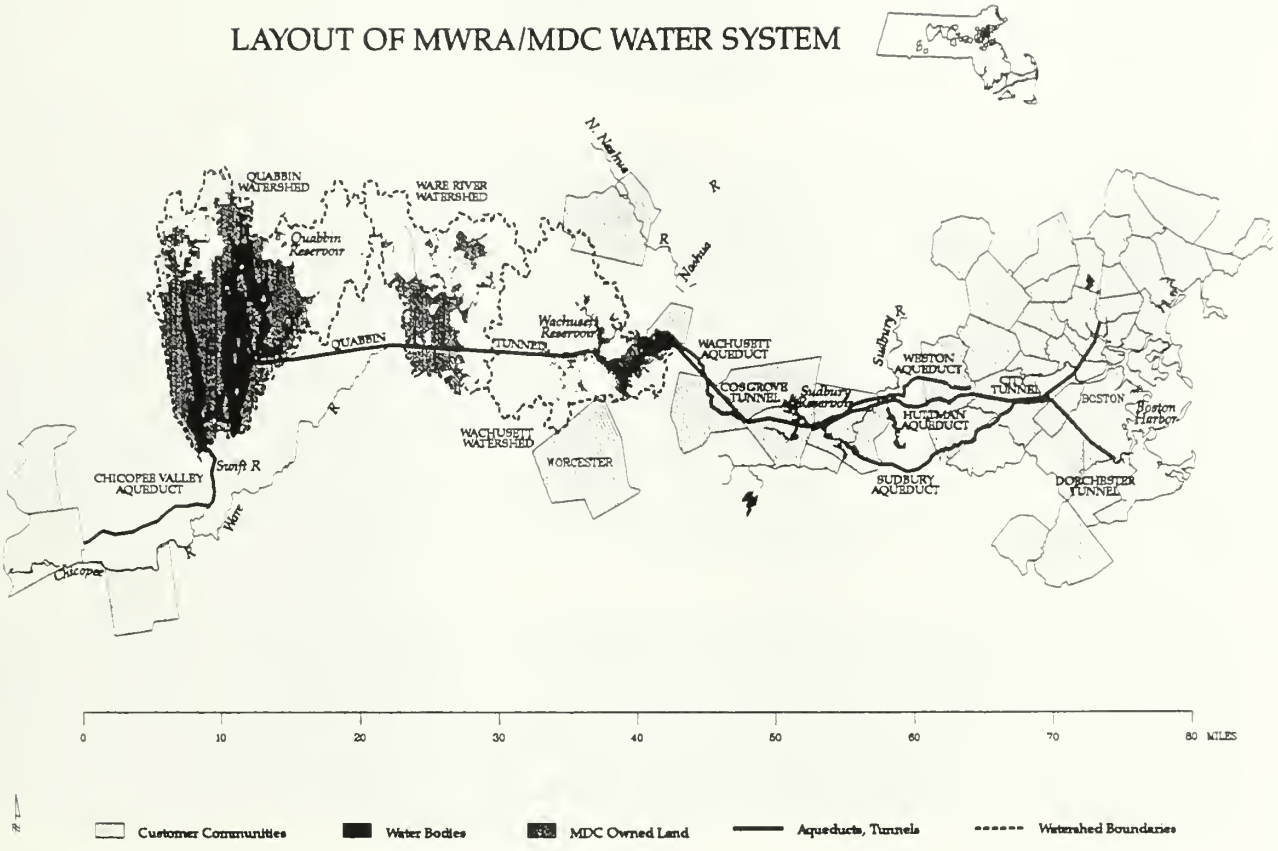
WATERWORKS SYSTEM IMPROVEMENTS

Overview

MWRA is committed to providing a reliable supply of high quality drinking water to its customers. In support of this goal, MWRA is undertaking a major capital initiative to ensure that the treatment, transport, and storage of water meets the highest quality standards and complies with state and federal regulatory requirements. The key elements of the initiative are the MetroWest Tunnel, the Walnut Hill Water Treatment Plant, construction of covered storage facilities, and rehabilitation of the distribution system. For additional information on the statutory and regulatory requirements which also shape the Waterworks capital programing see Appendix F.

While the wastewater system in general, and the Boston Harbor Project in particular, have been the focus of prior capital budgets, MWRA has made significant progress in the waterworks area, completing the rehabilitation of water pipelines in Stoneham, Woburn, Everett, and Chelsea; an interim corrosion control facility; the removal of Spot Pond and the uncovered Fells Reservoir from service; a primary disinfection facility at the Cosgrove Intake; rehabilitation of the Oakdale hydroelectric power generator; upgrade and replacement of chlorination facilities at Weston and Norumbega Reservoirs; and PCB and asbestos abatement programs.

LAYOUT OF MWRA/MDC WATER SYSTEM



Program Categories

MWRA divides the Waterworks System Improvements program areas into four categories: Drinking Water Quality Improvements, Transmission, Distribution and Pumping, and Other.

DRINKING WATER QUALITY IMPROVEMENTS

WATER QUALITY IMPROVEMENT PROGRAM
GENERAL INFORMATION AND OVERVIEW

The Drinking Water Quality Improvements (DWQI) category is comprised of projects to improve and preserve drinking water quality. MWRA maintains two active surface supply reservoirs, Quabbin and Wachusett, and three remaining open distribution reservoirs (Weston, Norumbega and Nash Hill). A fundamental component of the long-term plan to improve drinking water quality is the construction of the Walnut Hill Water Treatment Plant, a 405 million gallons per day treatment facility for the Wachusett Reservoir The plant will include disinfection, corrosion control, and enclosed storage facilities, and may include an ozonation or filtration component if the system fails to meet state and federal filtration avoidance standards or if the Board of Directors chooses filtration. The treatment technology decision has been scheduled for October 1998, in accordance with a schedule established with the Commonwealth's Department of Environmental Protection (DEP). The cost to complete a water treatment facility with a full filtration component is estimated to be $443 million, with a projected completion date of 2004.

As part of a complementary strategy to protect source water and actively treat drinking water supplies, the CIP budget includes projects designed to preserve and protect the natural watersheds which supply the Quabbin and Wachusett Reservoirs. The Watershed Protection project includes MWRA's contribution of $8.6 million for the construction of sewers for the towns of West Boylston and Holden, which are located in the Wachusett Reservoir watershed. A watershed protection plan for the Sudbury Reservoir, MWRA's only emergency water supply source, is also underway.

The CIP includes storage facilities which will provide a total of 290 million gallons of storage. The existing Norumbega Reservoir is expected to be maintained to provide an additional minimum of 75 million gallons of open storage for emergency back-up. The CIP includes the following covered storage facilities: a 50 million gallon clearwell at the Walnut Hill Water Treatment Plant, 115 million gallons at Norumbega Reservoir, 25 million gallons at the Nash Hill Reservoir, 30 million gallons at Blue Hills, 20 million gallons at the Fells Reservoir, 20 million gallons at the Weston Reservoir, 20 million for low service storage, 6 million for Bear Hill, and 3.6 million for Bellevue Additional Storage.

TRANSMISSION

MWRA's water transmission system extends from the Quabbin Reservoir in western Massachusetts to metropolitan Boston. The system consists of a series of tunnels, aqueducts, and pipelines which

transport water from supply reservoirs to user communities. The current transmission system lacks redundant capacity to ensure continuous supply in the event of flow impairment in any aqueduct. The new MetroWest Tunnel and other projects will address this deficiency.

The MetroWest Tunnel will provide redundancy for the Hultman Aqueduct, which currently transmits 85 percent of the water to the service region. MWRA expects the new 17.5 mile tunnel to be operational in 2004, when it will become the system's primary transmission line. MWRA is also designing several other major projects in accordance with the tunnel's planned configuration and operational mode. The construction schedules for the Norumbega covered distribution storage facility and the Walnut Hill Water Treatment Plant coincide with the anticipated completion date for the MetroWest Tunnel.

The CIP also includes a project to restore to service the Winsor Dam hydroelectric plant. Repair of the dam in will allow MWRA to produce hydropower to supply the needs of MWRA and MDC buildings in the area, including the interim disinfection facility for the Quabbin Reservoir. Excess power could be sold, or potentially wheeled to other MWRA facilities.

Other projects in this category will replace control valves and sluice gates at the Wachusett and Sudbury Reservoirs, and provide a redundant water supply for the communities served by the Chicopee Valley Aqueduct through a series of connections to non-MWRA water systems in Springfield and Holyoke.

DISTRIBUTION AND PUMPING

MWRA's water distribution system within the metropolitan Boston area includes 275 miles of pipelines, many of which have inoperable valves and severely restricted carrying capacity. Many of the pipelines are between 40 and 100 years old and are reaching the ends of their useful lives. Almost 20 percent are more than 100 years old, and approximately 75 percent are unlined. MWRA has developed a renewal and replacement program to assure reliable service, prevent leakage, and preserve water quality.

The Distribution and Pumping category includes an extensive renewal and replacement program for distribution system components such as pipelines, valves, covered storage facilities, and pump stations. The CIP includes projects designed to complete the rehabilitation or replacement of 80 miles of pipeline and construct ten miles of new water mains at a total cost of $457 million. The pipeline renewal program began in 1990 and will continue for 30-40 years before changing to a maintenance program.

This section of the CIP includes 30 projects for the rehabilitation and improvement of Waterworks distribution and pumping facilities. Twenty-four of these projects involve rehabilitation of existing pipelines, are part of a long-range program to restore the system's old water mains to adequate condition. An overview of this program and general information about pipeline rehabilitation needs and methods are provided here as a common preface to the specific information presented in each of

the project descriptions.

Given the current condition of the distribution piping network, MWRA has identified a long-range need to rehabilitate nearly 200 miles of pipeline. MWRA plans to rehabilitate or replace approximately seven miles of existing pipeline each year. The 24 pipeline rehabilitation projects outlined in this CIP represent the first stage of this long-term program to renew the pipeline network.

Additionally, MWRA has invested in revenue meter modernization, resulting in more accurate billing of customer communities for water supplied by MWRA. Data from the new meters and telemetry system permits MWRA to monitor flows and water use throughout the system. The revenue meter project includes installation of 130 meters. The first two phases of the project were completed in 1994 at a cost of $12.9 million. The remaining phases have been incorporated into appropriate capital projects and the costs have been allocated accordingly.

The Distribution and Pumping category also includes $1.7 million for cathodic protection and $15 million to fund valve replacements through 2006. Cathodic protection systems retard corrosion on steel pipelines. Blow-off valve reduce the risk of water contamination, while mainline valves permit the isolation of pipe segments to facilitate service and repairs.

In concert with the pipeline rehabilitation and replacement projects described above, MWRA is modernizing and rehabilitating four pump stations, and designing the rehabilitation requirements of the system's five remaining pump stations. The existing stations range in age from 30 to 90 years. Many of them still operate with their original equipment.

OTHER

This category includes projects for equipment replacement, building and bridge repairs, central monitoring system development, mapping, and the Local Water Infrastructure Rehabilitation Assistance Program. The budget for these projects, expected to continue through 2008, is $31.9 million.

BUSINESS AND OPERATIONS SUPPORT

Overview

Projects included in the Business and Operations Support program have an MWRA-wide focus, and assist all divisions in achieving service goals. These projects include improvements to MWRA facilities which serve multiple operational and administrative purposes and may house a combination of staff from the Waterworks, Sewerage, Program Management, Finance, and Support Services divisions.

Project Status

The program includes four projects: North Maintenance Facilities, Fore River Staging Area, Business Systems Plan, and Technical Assistance.

- North Maintenance Facilities: This project consists of the construction of a new maintenance facility to consolidate activities now housed at facilities.

- Fore River Staging Area: This project includes multiple contracts for improvements and the stabilization of buildings housing MWRA operations.

- Business Systems Plan: The Business Systems Plan is organized in five phases, including a new phase to remediate Year 2000 problems. Each phase is comprised of multiple projects related to maintaining and improving MWRA's communications and computer infrastructure.

- Technical Assistance: This project is comprised of a portfolio of contracts for specialized technical support, including environmental testing, land appraisal, and energy consulting.

Wastewater

Waterworks

and Support

Quincy Pump Facilities (102)

Purpose

MWRA's three pump facilities in Quincy (Quincy, Squantum, Hough's Neck) are beyond their useful lives and prone to failure. Force mains connected to the stations are corroded and maintain a very low velocity resulting in high energy losses because of friction and other flow constraints. Under this project MWRA will construct new pump stations and rehabilitate force mains to ensure continuous pumping of sewage flows to treatment facilities.

Project History and Background

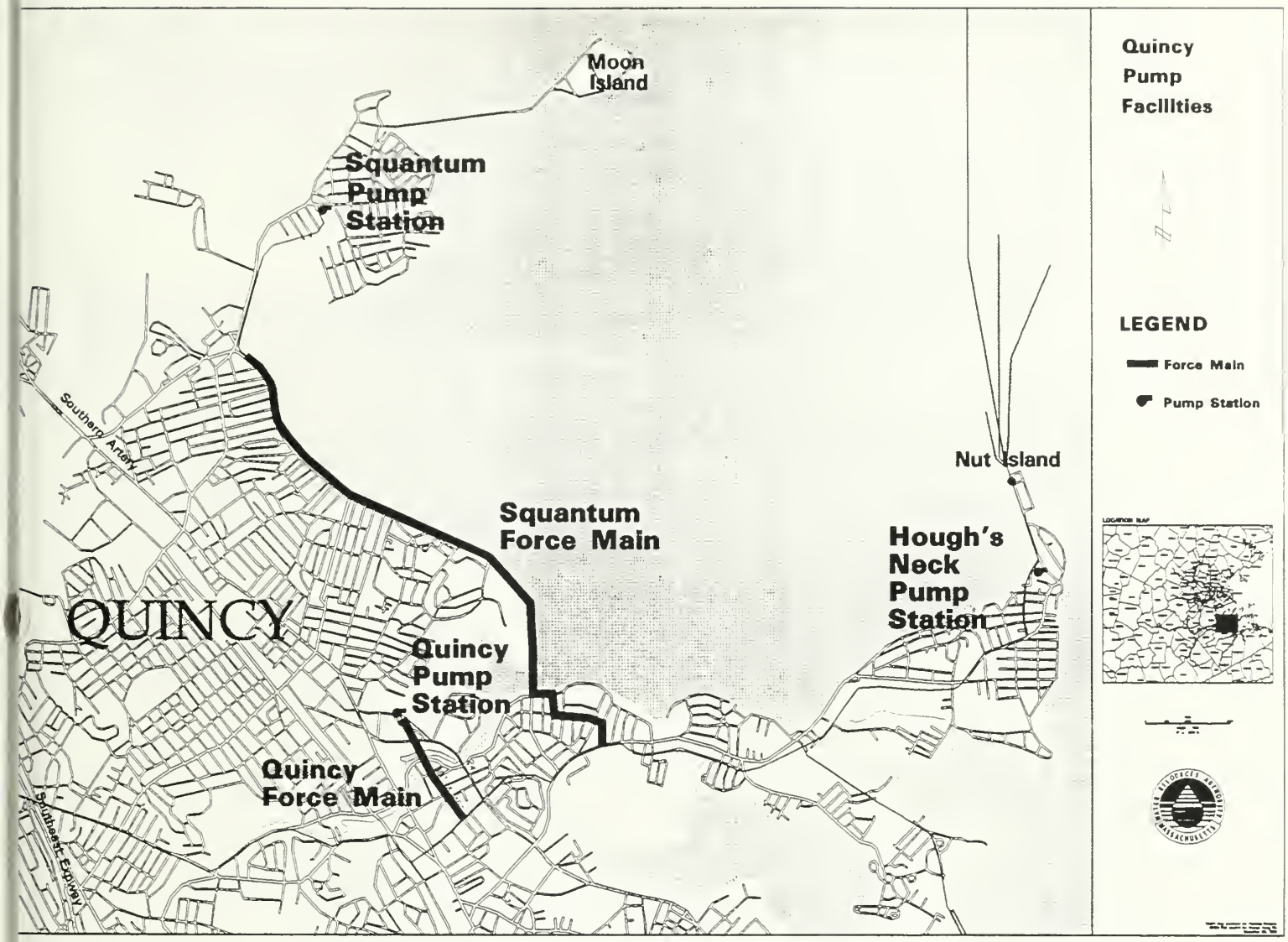
The Quincy pump facilities, serving the City of Quincy, include:

- Quincy Pump Station, a 21.5 million gallons per day (mgd) facility in operation since 1906.
- Squantum Pump Station, an eight mgd facility built in the late 1930s.
- Hough's Neck Lift Station, a one mgd facility in service since 1942.
- Quincy Force Main, comprised of two 3,000 foot force mains. One main, 24 inches in diameter, was built in 1902 and has a remaining useful life of less than five years. The other, 30 inches in diameter, was built in 1923.
- Squantum Force Main, built in 1972, 19,000 feet long, and ranging in diameter from 24 to 30 inches.

Scope

Subphase	Scope
Facilities Plan/EIR	Evaluate existing conditions, propose improvements, and assess the impacts of those improvements.
Design/CS - Rehab	Design of the Construction-Rehab subphase.
Construction - Rehabilitation	Short term improvements: installation of a heating unit and a prime mover at Quincy Pump; two four mgd pumps with AC drives, ships ladders, back-up equipment, and an additional four mgd sewage pump to serve as an emergency back-up at Squantum Pump; electrical upgrade including alarm and generator room improvements.
Land Acquisition	Acquire land for new Squantum Pump Station.

Design/CS/RI 1	Provide design & CS/RI for Construction 1-3, 5, & 6.
Construction 1	Construction of new eight mgd Squantum Pump Station.
Construction 2	Construction of new 26 mgd Quincy Pump Station.
Construction 3	Construction of new 1.5 mgd Hough's Neck Lift Station.
Construction 4	Rehabilitation of 4,576 linear feet of the Squantum Force Main through installation of a cured-in-place resin-impregnated flexible liner.
Construction 5	Rehabilitation of the remaining 14,400 linear feet of the Squantum Force Main by cleaning and application of a cementitious lining.
Construction 6	Rehabilitation of the existing 30-inch Quincy Force Main and abandonment of the existing 24-inch Quincy Force Main.
Technical Assistance	Design services for Squantum Force Main early rehabilitation and Construction 4 subphase.
Legal	Legal expenses, associated with resolving construction issues, design issues or claims.
Public Relations	Expenses associated with resolving technical issues arising from project implementation with the community and project abutters.
Hazardous Waste	Disposal of hazardous waste identified during construction.



Quincy Pump Facilities
Interception and Pumping

Braintree-Weymouth Relief Facilities (104)

Purpose

Construction of new relief facilities and the resulting reduction in community infiltration and inflow will provide capacity for peak sewage flow from Braintree, Hingham, Holbrook, Randolph, Weymouth, and sections of Quincy. This project will reduce surcharging in Braintree and Weymouth, and will reduce frequent sewage overflows into the Weymouth Fore River.

Project History and Background

The Braintree-Weymouth interceptor system and pump station serve Braintree, Hingham, Holbrook, Randolph, Weymouth, and sections of Quincy. Because of population increases the sewerage system cannot support the volume of sewage received. Sewage overflows are severe and frequent along the Weymouth Fore River.

Interim rehabilitation work is required to ensure continued operation of the existing Braintree-Weymouth Pump Station during the long-term design and construction period. Rehabilitative work completed to date includes installation of a motorized influent gate and a mechanical bar screen, as well as heating improvements.

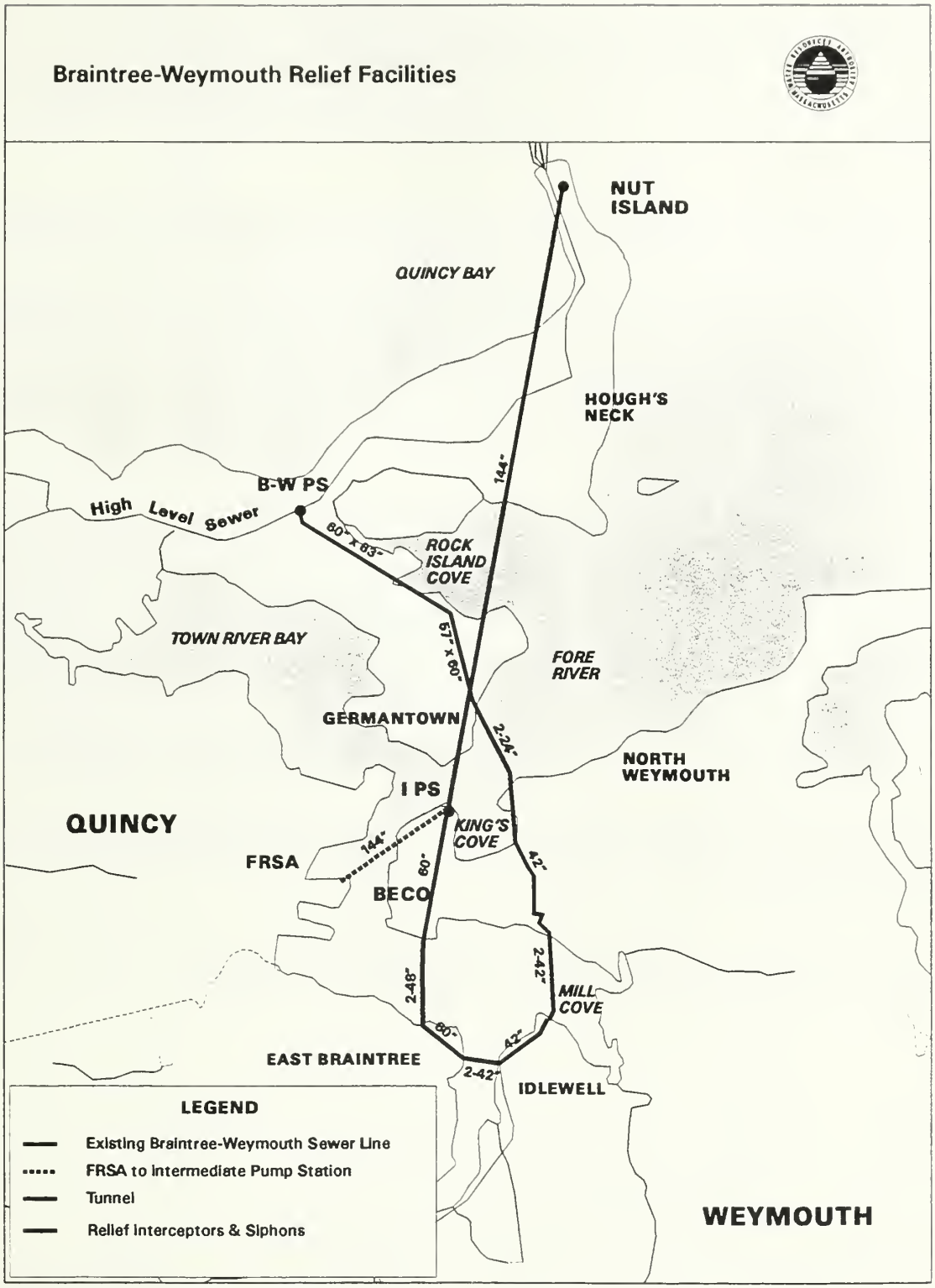
After proceeding with a dual track design approach for part of this project, MWRA has decided to construct a deep rock tunnel rather than a marine pipeline from the new pump station to the Nut Island shaft of the Inter-Island Tunnel.

Scope

Subphase	Scope
Draft Facilities Plan	Prepare Facilities Plan for work associated with the Braintree-Weymouth project.
Draft EIR	Prepare EIR for work associated with the Braintree-Weymouth project.
Final EIR /Facilities Plan	Planning and EIR work associated with the revised Braintree-Weymouth project.
Geotechnical-Land	Geotechnical investigation of areas associated with construction on land.
Geotechnical-Marine	Geotechnical investigation of areas associated with construction in river and harbor.
Design 1/CS/RI - Tunnel & IPS	Design of construction contracts 1 & 2. Includes completion of design modifications for valve chamber at Deer Island.

Design 2/CS/RI - Surface	Design of construction contracts 3 through 8, siphons, and Braintree-Weymouth relief pump stations.
Design 3/CS/RI Marine Pipeline	Design of marine pipeline alternative. Design was discontinued in favor of deep rock tunnel.
Sediment Tests	Assist with evaluation of marine pipeline option.
Land Acquisition	Purchase pump station land from Boston Edison; acquire easements for relief sewer from Braintree and Weymouth property owners, and other land owners.
Construction 1	Construction of a 2.9 mile, 12-foot diameter tunnel beginning at the Nut Island shaft and ending at the Fore River Staging Area. Two 14-inch sludge pipelines will convey Deer Island sludge from the Inter-Island Tunnel to the pelletizing plant. 0.4 miles of twin 14-inch filtrate pipelines will convey filtrate from the pelletizing plant to the North Weymouth Pump Station. 2.5 miles of 48-inch force main will carry relief flows and filtrate to the Inter-Island Tunnel.
Construction 2	Construction of a 60-mgd pump station/headworks in North Weymouth. Also includes modifications to the sludge pumping facilities at Deer Island and the filtrate pumping facilities at Fore River.
Construction 3	Construction of 2,000 linear feet of 60-inch gravity sewer running from the North Weymouth Pump Station and along the Boston Edison Edgar Station property.
Construction 4	Installation of a 48-inch, 1,800 feet long twin siphon from the Edison site across the Fore River to E. Braintree.
Construction 5	Construction of 1,000 linear feet of 60-inch gravity sewer along the E. Braintree shoreline to a new 42-inch, 800 linear feet siphon between E. Braintree and Weymouth and then extending 2,100 linear feet along the shore of Idlewell to Mill Cove.
Construction 6	Construction of a new 13-mgd Braintree-Weymouth Pump Station to handle approximately 19 percent of current flow.
Construction 7	Reducing the size of the existing 1,700 linear feet of the twin 54-inch Fore River Siphon by inserting a twin 24-inch siphon within the existing siphon from Germantown to N. Weymouth.
Construction 8	Reducing the size of 2,800 linear feet of 60-inch N. Weymouth sewer by inserting a 42-inch sewer within the existing sewer.
Construction 9	Installation of 1,700 linear feet of 42-inch siphon pipe between Newell Playground and Aspirwall St. in No. Weymouth to act as a second barrel of the existing Mill Cove Siphon, to alleviate overflows upstream until facilities are on-line in FY02.
Construction 10	Rehabilitation of Braintree-Weymouth Section 124. Section 124 is part of the existing Braintree-Weymouth Interceptor in North Weymouth and is located between Mill Cove and King's Cove.
Design-Rehab	Design of Construction-Rehab phase.
Constr-Rehab	Interim rehabilitation of the existing Braintree-Weymouth Pump Station that includes relocating an existing A.C. generator with a D.C. rectifier and new vacuum pumps. The Transport Department will install existing generators instead of buying new emergency generators.
Legal	Legal expenses associated with resolving construction issues, design issues, or claims.

Public Relations	Expenses associated with resolving technical issues arising from project implementation with the community and project abutters.
Hazardous Waste	Disposal of hazardous waste identified during construction.
Technical Assistance	Installation of a sluice gate and a bar screen.


Braintree-Weymouth Relief Facilities
NUT ISLAND
QUINCY BAY
HOUGH'S NECK
144"
B-W PS
High Level Sewer
60" x 83"
ROCK ISLAND COVE
TOWN RIVER BAY
51" x 60"
FORE RIVER
GERMANTOWN
2-24"
NORTH WEYMOUTH
I PS
QUINCY
KING'S COVE
144"
FRSA
60"
42"
BECO
2-42"
2-48"
MILL COVE
60"
42"
EAST BRAINTREE
2-42"
IDLEWELL
LEGEND
Existing Braintree-Weymouth Sewer Line
FRSA to Intermediate Pump Station
Tunnel
Relief Interceptors & Siphons
WEYMOUTH

New Neponset Valley Relief Sewer (105)

Purpose

Structural and hydraulic deficiencies in the New Neponset Valley Interceptor Sewer System led to surcharging and sewage overflows which, combined with other pollution, threatened the Neponset River Watershed, the water supply for Canton and the Dedham/Westwood Water District. Construction of new relief facilities is mitigating these problems and will accommodate an anticipated increase in demand caused by population growth in the service area. The project was substantially completed in September 1996, with remaining contract activity related to environmental monitoring and remediation of flooding problems.

Project History and Background

The New Neponset Interceptor Sewer System consists of the New Neponset Valley Sewer, the Westwood Extension Sewer, the Walpole Extension Sewer, the Stoughton Extension Sewer, and the Dedham Branch Sewer. The system serves Walpole, Stoughton, Canton, Norwood, Westwood, and parts of Dedham, Hyde Park, and Milton. Structural deficiencies within the system included deteriorated manhole risers, improper castings, structural damage due to superimposed loadings, and segments that required cleaning. Hydraulic problems included a six mgd deficiency in the downstream segment and an approximately 22 mgd deficiency in several upstream segments during heavy rainfall, resulting in surcharging and sewage overflows to ground surfaces and adjacent water bodies.

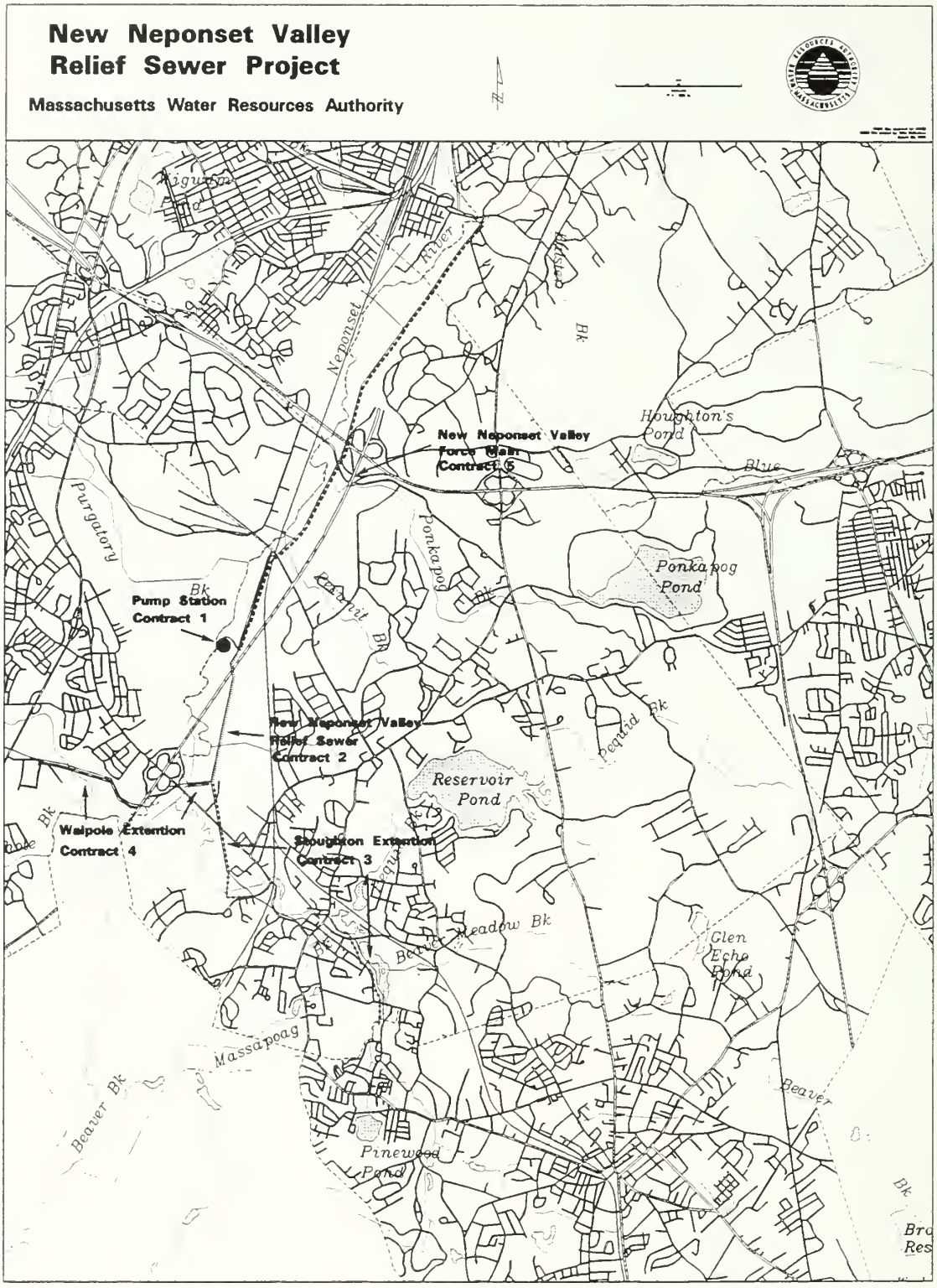
The sewered population in this area is expected to increase from 81,000 to 136,600 by 2002 primarily due to the expected conversion from septic tanks to sewer service in the towns of Canton, Stoughton, Walpole, and Westwood.

Construction of the new relief facilities commenced in 1993. The pump station began operating in March 1996. The interceptor was placed into service in September 1997.

Scope

Subphase	Scope
Facilities Plan	Evaluation of existing conditions, proposed improvements, and assessment need of the impacts of those improvements.
EIR/Supp. Facility Plan	Further evaluation required and performed through MEPA.
Design/CS/RI	Design and CS/RI for Construction contracts 1-5.
Land Acquisition	Land taking, easements, and litigation.

Consultant-Canton	Engagement of an environmental monitor for the Canton Conservation Commissions to oversee wetlands related work. Services continued through November 1997.
Construction 1	Construction of a 46-mgd pump station and 2,850 linear feet of 48-inch force main.
Construction 2	Installation of 5,900 linear feet of 54-inch gravity sewer for the New Neponset Valley Relief Sewer.
Construction 3	Installation of 5,330 linear feet of 36-inch gravity sewer for the downstream section and 4,055 linear feet of 24- to 30-inch gravity sewer for the upstream section of the Stoughton Extension Sewer.
Construction 4	Installation of 6,920 linear feet of a 30- to 48-inch gravity sewer for the Walpole Extension Sewer.
Construction 5 & Consultant-Milton	Installation of the remaining 18,544 linear feet of 48-inch force main for the New Neponset Valley Relief System. Also, engagement of an environmental monitor for the Milton Conservation Commission to oversee wetlands related work.
Study Dedham Street	Study to determine if a section of settled sewer line was repaired in the early 1960s and whether it may have contributed to groundwater contamination.
Power Line	Installation of power and telephone utilities.
Technical Assistance	Ongoing environmental assistance contracts (wetlands restoration and revegetation experts, experts on endangered species, etc.)


New Neponset Valley
Relief Sewer Project
Massachusetts Water Resources Authority
Neponset River
Houghton's Pond
New Neponset Valley
Force Main
Contract 5
Purgatory
Pump Station
Contract 1
Ponkapog
Pond
New Neponset Valley
Relief Sewer
Contract 2
Reservoir
Pond
Walpole Extention
Contract 4
Stoughton Extention
Contract 3
Meadow Bk
Glen
Echo
Pond
Massapoag
Beaver Bk
Pinewood
Pond
Beaver

Upper Neponset Valley Sewer System (132)

Purpose

The Upper Neponset Valley Sewer is hydraulically deficient resulting in frequent community system back-ups and interceptor overflows to adjacent residential areas and water bodies in Brookline, Boston, Newton, Dedham, and Hyde Park. Construction of a new relief interceptor will reduce chronic wastewater overflows and surcharging and improve service and water quality.

The project includes the preparation of a Facilities Plan/EIR for the analysis and evaluation of alternatives for hydraulic relief of the upstream (Upper Neponset Valley) and downstream (Neponset Valley) sections of this sewer system.

Project History and Background

The Upper Neponset Valley Sewer (UNVS), constructed between 1896 and 1902, extends approximately four miles through the towns of West Roxbury and Newton, and receives wastewater from West Roxbury, Brookline, Newton, and a small portion of Dedham.

While the sewer's average daily flow is 7.2 mgd, and peak flow is 23.6 mgd, the size and slope of the sewer, both of which affect capacity, change dramatically in some areas, especially in Sections 26 through 29. Section 29 ranges from a 12-inch circular pipe upstream to a 26-inch oblong pipe downstream. The sewer expands to a 45-inch by 48.5-inch oblong shape at the furthest downstream portion, Section 26. The hydraulic capacity of these sections ranges from a low of 5.8 mgd to a high of 11.65 mgd with several capacity constraints. The differences between actual flows and the hydraulic capacity results in serious overflows and surcharges during periods of heavy rainfall.

The 1984 Wellesley Extension Sewer Facilities Plan/Environmental Impact Document (EID) estimated that the UNVS overflowed an average of six to ten times per year with occurrences lasting as long as ten days. The Facilities Plan/EIR indicated that the installation of a new 10,800 foot interceptor is the most cost effective solution to these problems. With the increased capacity of the new interceptor ranging from 15.65 to 25.7 mgd, chronic wastewater overflows will be reduced, improving water quality.

The Neponset Valley Sewer, constructed between 1895 and 1898, is approximately three miles in length and runs along River Street to Business Street, paralleling the Neponset River in Hyde Park and Dorchester. The 1994 Final CSO Conceptual Plan indicated a hydraulic deficiency in this sewer, with recommendations for a follow-on Facilities Plan.

Scope

Subphase	Scope
Planning	Evaluation of alternatives and recommendation to install a new 28,100 foot interceptor or the most cost-effective solution.
Designs/CS/RI	Design, resident inspection, and construction services during the Construction phase.
Land Acquisition	Estimated costs for land and easements.
Legal	Legal expenses associated with resolving construction issues, design issues, and claims.
Public Participation	Costs associated with community relations work.
Hazardous Waste	Costs associated with hazardous waste.
Construction	Installation of a new 28,100 foot interceptor to reduce overflows to adjacent residential areas and water bodies in Brookline, Boston, Newton, Dedham, and Hyde Park.

Wellesley Extension Sewer Replacement (106)

Purpose

The Wellesley Extension Sewer System has been unable to convey all flows, resulting in surcharging and overflows into the Charles River in parts of Dedham, Needham, Wellesley, Dover, and Natick, and endangering two water supplies: the Needham town wells and the Elm Bank Aquifer. Construction of a replacement sewer has largely alleviated capacity constraints, improved the water quality of the Charles River, protected the aquifers, and reduced back-ups in Needham and Dedham. The rellining of 19,100 feet of the sewer is the last remaing phase of the project (Construction 8).

Project History and Background

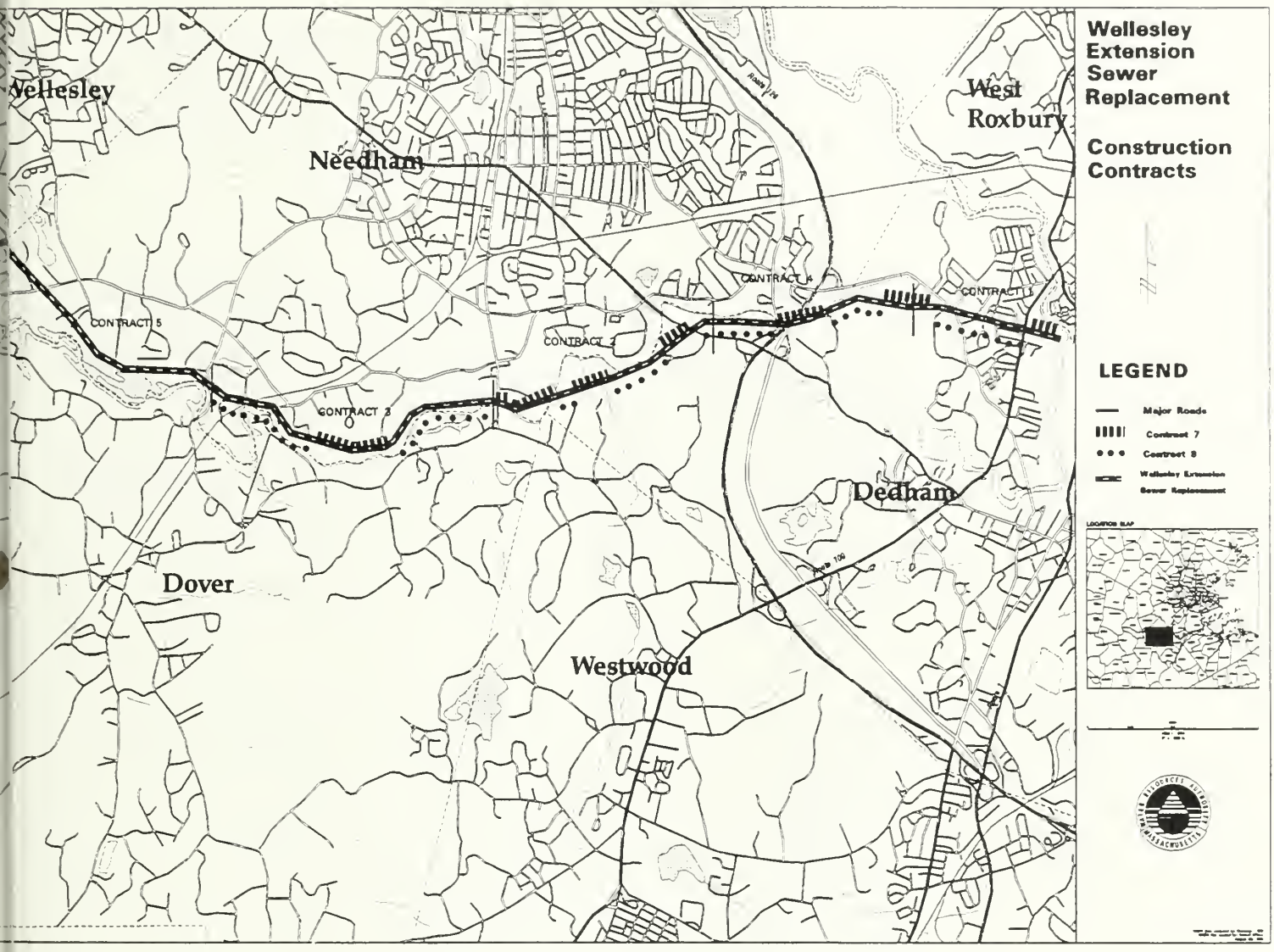
The Wellesley Extension Sewer System is comprised of the Wellesley Extension Sewer, constructed between 1916 and 1921, and the Wellesley Extension Relief Sewer. Both sewers are situated along the Charles River and serve Needham, most of Wellesley, and part of Dedham. The Framingham Extension Sewer is also tributary to the Wellesley Extension Sewer System.

Seven of the project's eight construction contracts have been completed.

Scope

Subphase	Scope
Study	Evaluation of existing conditions, proposed improvements, and evaluation of the impacts of those improvements.
Design/EIR/CS/RI	Completion of design and environmental studies and provision of construction services/resident inspection during the construction phase.
Land Acquisition	Land taking, easements, and litigation to facilitate construction phases.
Consultant-Needham, Dover, Dedham	Engagement of consultants for the Needham, Dover, and Dedham Conservation Commissions to oversee wetlands related work performed in their respective jurisdictions.
Construction 1	Installation of 4,850 linear feet of 60-inch interceptor in Dedham, including a 3,040 linear feet tunnel, and abandonment of 300 linear feet of the Wellesley Extension Sewer (WES).
Construction 2	Installation of 6,720 linear feet of 54- to 60-inch interceptor in Dedham and Needham, including a 230 linear feet river crossing and a 215 linear feet brook crossing.
Construction 3	Installation of 10,300 linear feet of 60-inch interceptor in Needham, including a 1,200 linear feet tunnel.

Construction 4	Installation of 6,170 linear feet of 54- to 60-inch interceptor in Dedham including a 160 linear feet pipe crossing the Charles River, a 450 linear feet Route 128 crossing, and the abandonment of 2,900 linear feet of the WES.
Construction 5	Installation of 9,500 linear feet of 60-inch interceptor in Needham, Wellesley, and Dover, including a 120 linear feet river crossing.
Construction 6	Installation of 7,540 linear feet of eight to 15-inch local sewers in Dedham and Needham, sliplining 1,600 linear feet, and abandoning 9,990 linear feet of the WES.
Construction 7	Rehabilitation of 37,217 linear feet of the Wellesley Extension Relief Sewer, relining of 8,850 linear feet of the Wellesley Extension Sewer Replacement (WESR), and abandoning 17,250 linear feet of the WES. Relining an additional 978 linear feet of the WERS.
Construction 8	Relining of 19,100 linear feet of the WESR.
Engineering and Inspection Consultant	Consulting services for design and inspection of protective coating systems to be installed in the replacement Construction 8.
Legal	Legal expenses associated with resolving construction issues, design issues, and claims.
Public Relations	Expenses associated with resolving technical issues arising from project implementation with the community and project abutters.
Technical Assistance	Preliminary assessment of contamination associated with Construction 1.


Wellesley
Needham
West Roxbury
Dedham
Dover
Westwood
CONTRACT 5
CONTRACT 4
CONTRACT 3
CONTRACT 2
CONTRACT 1
Wellesley Extension Sewer Replacement
Construction Contracts
LEGEND
Major Roads
Contract 7
Contract 8
Wellesley Extension Sewer Replacement
LOCATION MAP

Framingham Extension Relief Sewer (107)

Purpose

The Framingham Extension Sewer has inadequate capacity to serve current and projected demand, resulting in surcharging and discharging of sewage into local water bodies such as the Charles River and Beaverdam Brook. The installation of a new force main, construction of a new pump station, and rehabilitation of more than 23,000 linear feet of existing pipe will provide sufficient capacity to transport peak flows and reduce overflows.

Project History and Background

The Framingham Extension Sewer, constructed in the mid 1950s, is approximately 31,150 feet in length, with a diameter varying between 42 and 54 inches. The sewer receives wastewater from the towns of Framingham, Ashland, and Natick and transports these flows to the Wellesley Extension Sewer for eventual conveyance to the Deer Island Treatment Plant. The current peak wet weather flow is approximately 42.75 mgd.

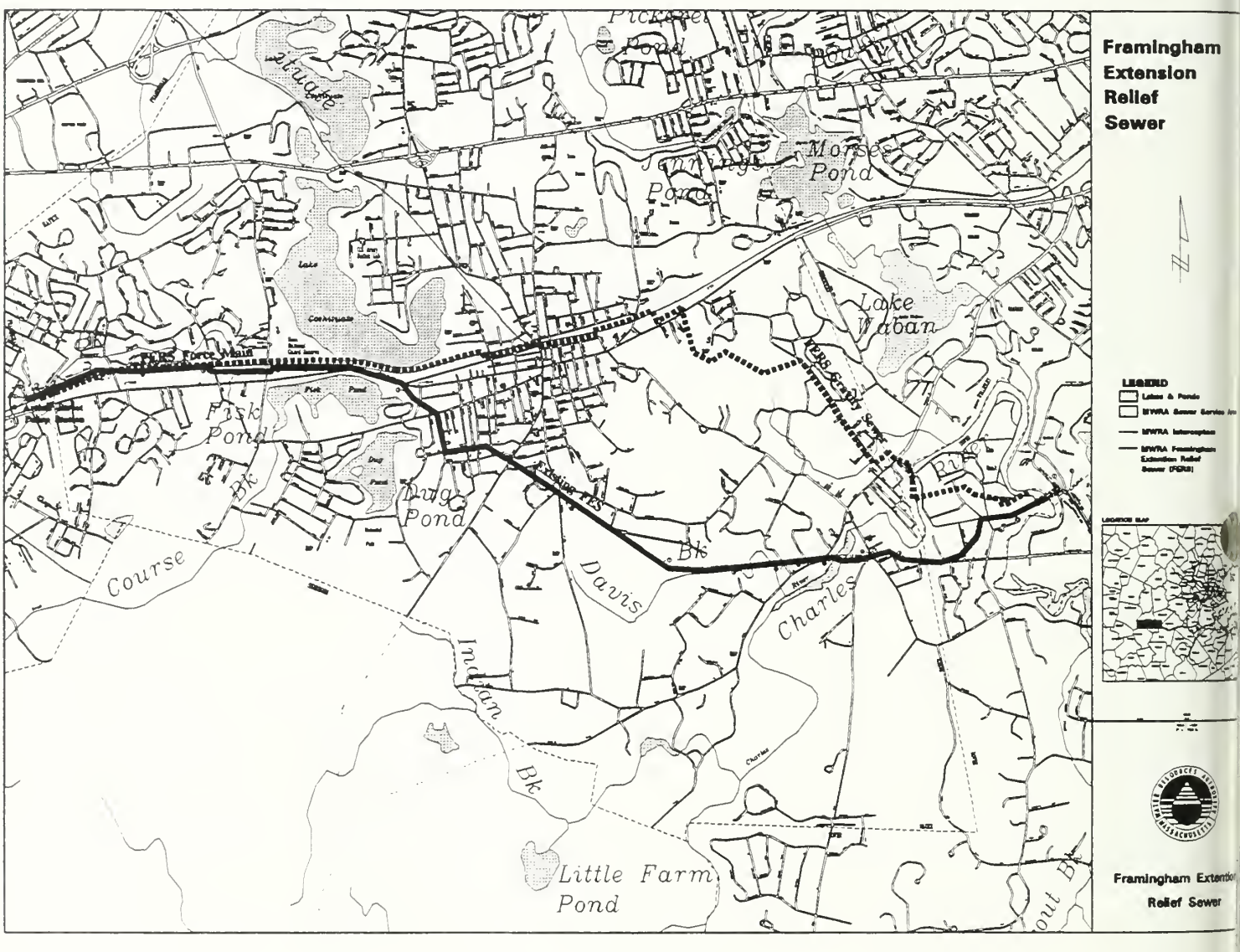
Insufficient capacity and the aging of the pipes have led to deterioration and excessive discharging of the sewer system.

The new sewer system is designed for a peak flow of 43.65 mgd.

Scope

Subphase	Scope
Facility Plan Update/EIR	Evaluation of existing conditions, proposed improvements, and evaluation of the impacts of those improvements.
Land Acquisition	Land taking, easements, and litigation (if necessary) to facilitate construction.
Design/CS/RI	Design and construction services for Construction phases, including alternative option of jacking a portion of the gravity sewer, and additional conditions for restoration of the Charles River banks.
Construction 1	Installation of 25,000 linear feet of 36-inch force main in Framingham and Natick.
Construction 2	Installation of 11,000 linear feet of 36-to 60-inch gravity sewer in Natick, Wellesley, and Dover. Microtunneling under a 150-year old oak tree on Elm Bank.
Construction 3	Construction of a 21-mgd pump station in Framingham.
Construction 4	Rehabilitation of 7,439 linear feet of 42- to 48-inch sewer in Framingham and Natick.

Construction 5	Rehabilitation of 15,830 feet of sewer in Natick and Dover.
Technical Assistance	Technical assistance as needed in support of all construction contracts.


Framingham
Extension
Relief
Sewer
Morse
Pond
Lake
Waban
Fisk
Pond
Course
Bk
Dug
Pond
Davis
Bk
Charles
Indian
Bk
Little Farm
Pond
LEGEND
Framingham Extension
Relief Sewer

Cummingsville Replacement Sewer(127)

Purpose

Capacity deficiencies in the MWRA system may be associated with overflows of local sewers upstream from the Cummingsville Branch System. In addition, sewer moratoriums are in effect in the upstream communities of Woburn and Burlington. Construction of a replacement sewer and rehabilitation of existing sewers will provide additional capacity to ensure adequate and reliable wastewater service for upstream communities.

Project History and Background

The Cummingsville Branch Sewer System is located in the Town of Winchester and receives wastewater from sections of Winchester and Woburn and all of Burlington. The Cummingsville Branch Sewer System consists of the Cummingsville Branch Sewer, constructed around 1894, and the Cummingsville Branch Relief Sewer, constructed in 1952.

The existing system consists of 9,475 linear feet of 15- to 30-inch pipeline and has a capacity of 13 mgd. The 1975 Eastern Massachusetts Metropolitan Study recommended relief of the Cummingsville Branch Sewers to meet wastewater demand.

In 1988, MWRA informed local and state officials that the Cummingsville Branch Sewers would be on a priority list in any future sewer planning and design efforts.

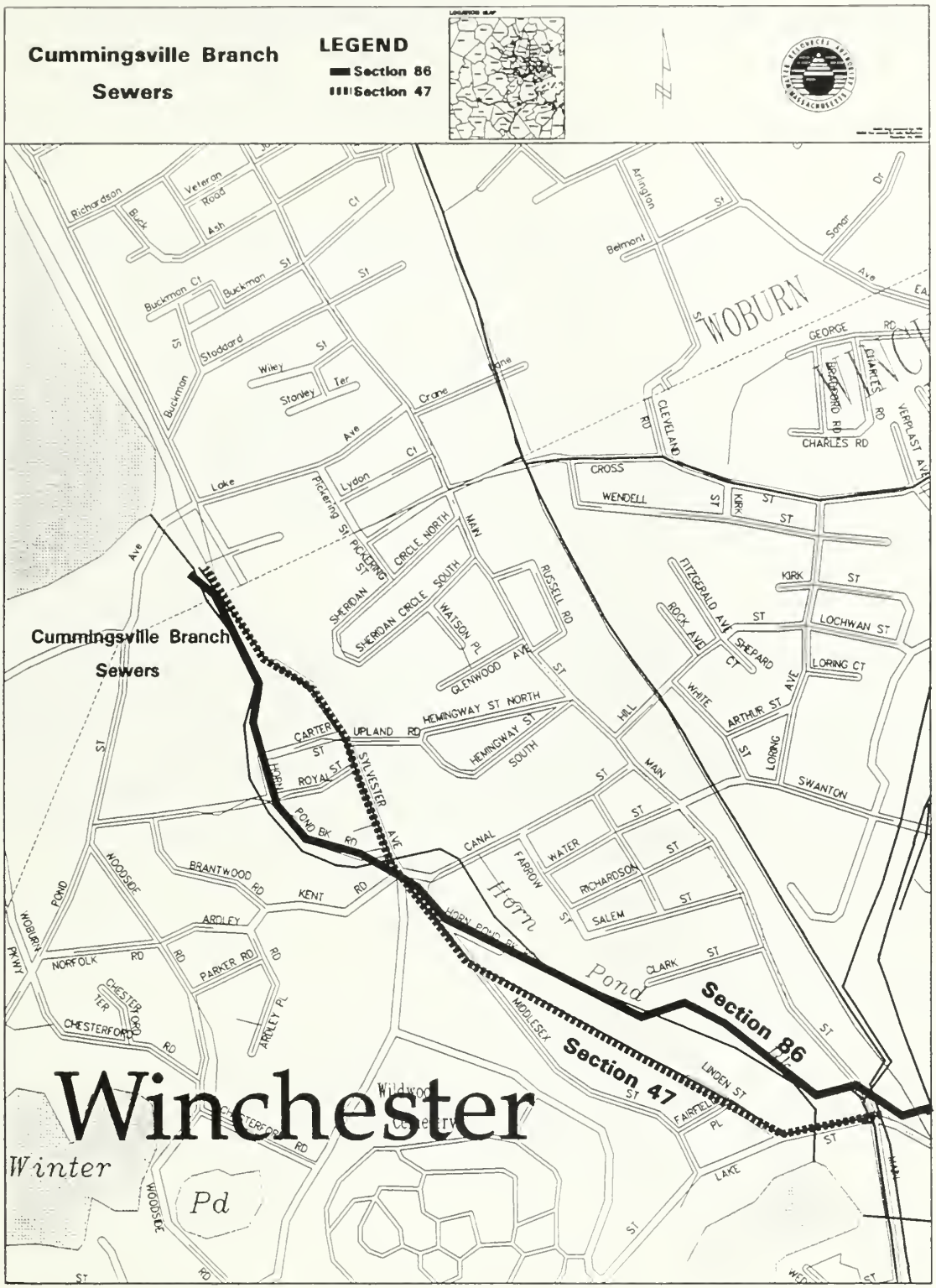
In 1992, MWRA commenced facilities planning to study the adequacy of the system. Analysis of existing capacity and future expected flows resulted in identification of a system deficiency of approximately eight mgd. In addition, internal television inspection of the sewers revealed cracks, infiltration, spalling, poor joint conditions, and root intrusion which compromise the structural and hydraulic integrity of these lines. Extensive evaluation identified the replacement of the Section 47 sewer with a new 36-inch gravity sewer as the preferred alternative. The replacement presents the fewest long-term environmental impacts, is the least expensive to construct and maintain, and renders unnecessary the extensive rehabilitation that would be required for this 100-year old sewer to remain in service.

The project also includes rehabilitation of the existing Section 86 and a small portion of Section 47 sewers to ensure their continued service.

In November 1994, MWRA received notice from the Secretary of Environmental Affairs that an Environmental Impact Report (EIR) would not be required for construction of the new sewer.

Scope

Subphase	Scope
Facilities Plan/EIR	Evaluation of potential adverse impacts associated with additional flows downstream and recommend items for improvements to the system.
Design/CS/RI	Design for construction phase.
Land Acquisition	Land taking, easements, and litigation (as required) to facilitate construction.
Construction (new sewer) and Rehab of existing sewers	Replacement of the Section 47 sewer with a new 36-inch gravity line. Cleaning and repair of the existing Section 86 sewer, along with a small portion of Section 47 which will remain active to carry local flows.


Cummingsville Branch Sewers
LEGEND
Section 86
Section 47
Cummingsville Branch Sewers
WOBURN
Winchester
Winter Pd
Horn Pond
Section 86
Section 47
Richardson
Veteran Road
Buckman
Ash
Stoddard
Wiley
Stanley
Crane
Lake
Lydon
Pickering
Sheridan
Circle North
Sheridan Circle South
Watson Pl
Glenwood Ave
Main
Russell Rd
Cleveland Rd
Arlington
Belmont
Sonar Dr
George Rd
Charles Rd
Cross
Wendell
Kirk St
Fitzgerald Ave
Rock Ave
Sheppard Ct
Lochwan St
Loring Ct
White
Arthur St Ave
Loring St
Swanton
Hill
Hemingway St North
Hemingway St South
Carter
Upland Rd
Royal St
Sylvester Ave
Pond Bk Rd
Canal
Water
Farrow
Richardson
Salem
Clark St
Middlesex
Linden St
Fairfield Pl
Lake
Brantwood Rd
Kent Rd
Ardley
Parker Rd
Norfolk Rd
Chesterford Rd
Chester Ter
Ardley Pl
Woodside
Pond
Woburn Pkwy

North Metropolitan Trunk Sewer Rehabilitation (Phase II) (129)

Purpose

To rehabilitate 19,700 linear feet of the 100-year old North Metropolitan Trunk Sewer (NMTS), to ensure that flows from the Caruso Pump Station in East Boston can be reliably transported to the Deer Island Treatment Plant.

Project History and Background

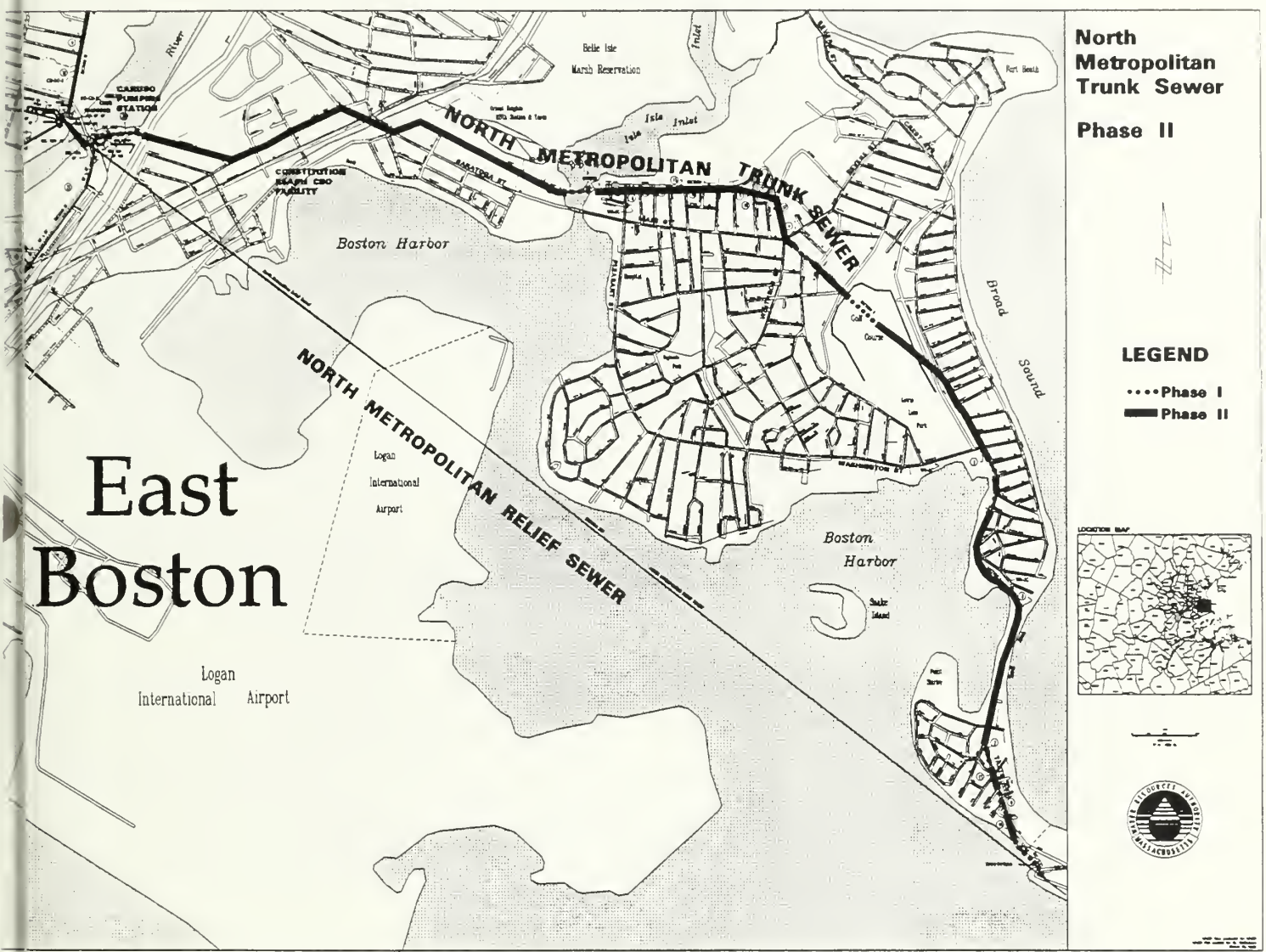
The NMTS, constructed in the 1890s, is a nine-foot diameter, 25,000-linear feet brick sewer connecting the Ignatius Caruso Pumping Station in East Boston to the Deer Island Treatment Plant. The NMTS conveys dry weather sewage from East Boston, Chelsea, Revere, and Winthrop as well as overflows from the Chelsea Creek Headworks which are diverted to the pumping station during wet weather conditions.

Rehabilitation of portions of the NMTS was completed under a separate construction contract as part of the MWRA East Boston Pumping Station Facilities project. During construction-related internal inspections of the NMTS, it became apparent that the repair method identified for the specified segments of pipe was insufficient and that additional areas required rehabilitation. Approximately 3,400 linear feet suffering from the most critical structural damage and in need of emergency repair were rehabilitated under the East Boston Pumping Station Rehabilitation project.

MWRA will rehabilitate the remaining 19,700 linear feet of the NMTS under this project.

Scope

Subphase	Scope
Design	In-house design of construction phase.
Construction	360 degree rehabilitation of 19,700 linear feet of the NMTS. Rehabilitation includes cleaning the sewer, placement of shotcrete with wire mesh, application of an epoxy lining system in manholes, sealing leaks with grout, and disposing of approximately 1,000 cubic yards of sediment and debris. Will use silica fume shotcrete coating in horizontal sections and epoxy coating in vertical chambers.


North
Metropolitan
Trunk Sewer
Phase II
LEGEND
Phase I
Phase II
NORTH METROPOLITAN TRUNK SEWER
NORTH METROPOLITAN RELIEF SEWER
East
Boston
Logan
International
Airport
Boston Harbor
Broad Sound
Belle Isle
Marsh Reservation
CARUSO PUMPING STATION
CONSTITUTION BEACH CSO FACILITY

Siphon Structure Rehabilitation (130)

Purpose

Hydraulic flows through many siphon chambers and connecting structures throughout the MWRA sewage collection system are below design capacities. The poor flow conditions, caused by irregular maintenance due to the inaccessibility of many structures, contribute to significant surcharges and overflows. The detention time of wastewater at many structures also contributes to serious odor problems. A study is underway to evaluate rehabilitation of these structures to permit greater accessibility to provide regular maintenance in order to alleviate the above problems.

Project History and Background

Siphon chambers are located at the upstream and downstream ends of depressed sewers. Depressed sewers are constructed to avoid obstructions in sewer alignments such as rivers and subsurface utilities. Upstream siphon chambers allow attainment of proper water elevation so that the depressed sewer flows under pressure. Downstream chambers provide transitions between depressed sewers and downstream gravity sewers.

Connecting structures are facilities at which flows from sewers are redirected to converge with, or receive flows from, other sewers.

There are 92 siphon chambers and 111 connecting structures located throughout the North and South Collection systems. Of this total, 83 siphon chambers and 63 connecting structures have been identified for inclusion in the study phase of this project.

Scope

Subphase	Scope
Planning	Identification of methods to improve accessibility, structural inspections of the siphon chambers and diversion structures, and recommendations for rehabilitation.
Land Acquisition	Costs related to acquiring construction and permanent easements.
Design/CS/RI	Design, engineering, and construction administration costs.
Construction	Construction at up to 110 sites.
Legal	Legal expenses associated with resolving construction issues, design issues, and claims.
Public Relations	Expenses associated to working with communities and site abutters to resolve technical issues arising from project implementation.

Wastewater Metering System Upgrade (101)

Purpose

MWRA must ensure that the community wastewater flow meter data used to calculate wholesale sewer charges is accurate, reliable, and defensible. Because the metering system was designed to allow for continual upgrade, existing meters may be relocated and additional ones may be added as needed. To ensure that at least 85 percent of flow in each community is metered, MWRA will add meters as needed in communities with less than 85 percent coverage, and replace some manhole meters with equipment at local pump stations.

Project History and Background

The final phase of the permanent wastewater metering system, completed in January 1994, consists of 212 meters operated and maintained by MWRA staff. MWRA uses data from the metering system for system planning, hydraulic modeling, quantification of I/I in community collection systems, and estimating each community's contribution to total wastewater flow. MWRA uses flow data to calculate wholesale sewer charges under its wastewater rate methodology.

Scope

Subphase	Scope
Design	Design phase was completed in-house; budget is for printing and permitting costs that support closure of the initial metering project and completion of the in-house design of system upgrades.
Construction	Addition of 15 wastewater meters to upgrade metered flow coverage in communities with less than 85 percent coverage and for those communities which expect flow metering errors greater than plus or minus five percent. Replacement of meters at manhole sites adjacent to local community pump stations with equipment directly connected to the pump stations. This type of meter installation has proven to be more reliable and requires less maintenance than manhole installations.

Ashland Extension Sewer (134)

Purpose

MWRA will study the feasibility of constructing an extension sewer from the Framingham Extension Relief Sewer to the Framingham/Ashland line. MWRA member communities without direct connections to the MWRA sewer system have expressed concern that their capacity for development may be negatively affected without these direct connections.

Project History and Background

The Massachusetts Legislature added a requirement to the Commonwealth's FY96 budget that MWRA perform a feasibility study and design to extend the Framingham Relief Sewer to the boundaries of contiguous member communities. The selected design consultant will evaluate the effect of the new flows on Ashland's sewerage system and MWRA's Framingham interceptor, will assess the need for construction of a new sewer and auxiliary pumping facilities, and will evaluate environmental and community impacts.

At this preliminary stage, the alignment of the project has not been finalized. The proposed project would commence at the Framingham/Ashland town line and would tie into MWRA's Framingham Extension Relief Sewer (FERS) interceptor at the Arthur Street DPW yard in Framingham.

Construction costs may vary depending on whether existing facilities can be modified to meet the hydraulic requirements, or whether new construction will be required.

Scope

Subphase	Scope
Planning/Design	Feasibility study, cost analysis, and if necessary, designs for projects necessary to extend the Framingham Relief Sewer into the Town of Ashland.
Land Acquisition	Project may require access to private property during the planning phase.


Ashland Extension Sewer
Community Sewer Map
MWRA Sewerage Division
Hager Pond
Broad Meadow Bk
Landham
Sudbury River
FRAMINGHAM
Sudbury
Angelica
Reservoir
SOUTH-
BOROUGH
Birch Meadow Bk
Massachusetts Turnpike
Lake Cochituate
Reservoir No.3
No.1
No.2
Farm Pond
NATICK
Route 9
ASHLAND
Sudbury River
Indian Bk
Hopkinton Reservoir
Framingham Extension Sewer
Ashland Reservoir
SHERBORN
HOPKINTON
HOLLISTON
Popping Bk
Chicken Bk

System Master Plan (SMP) Interceptors (135)

Purpose

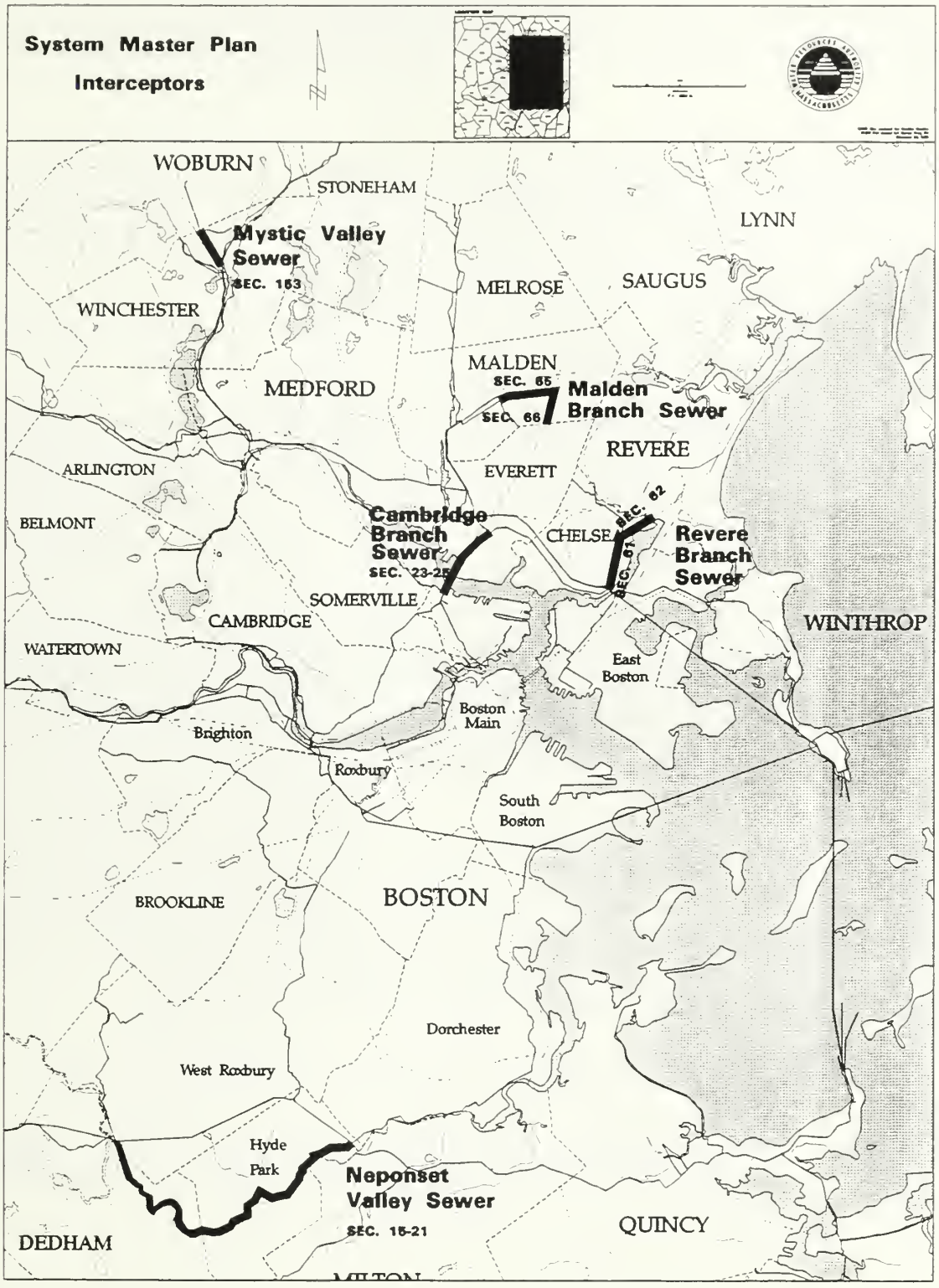
The project will reduce surcharging by rehabilitating or replacing four interceptors: Mystic Valley, Revere Branch (Section 62), Cambridge Branch, and Malden Branch.was added to the Upper Neponset Valley Project.

Project History and Background

The Final CSO Conceptual Plan and System Master Plan (SMP), published in December 1994, recommended that MWRA proceed with 13 Priority A and B projects. Priority A projects were defined as conduits that surcharge to within six feet of the ground surface or contribute to sanitary sewer overflows. Priority B projects were defined as conduits that surcharge, but where hydraulic grade line is predicted to be six feet or more below the ground surface. This project includes the preparation of a facilities plan and an environmental impact report for the upgrade of four interceptor systems, and capital improvements as necessary, for two Priority A conduits and two Priority B conduits. The facilities plan will recommend design alternatives for each of the four interceptors as a follow-up to the initial findings of the CSO System Master Plan.

Scope

Subphase	Scope
Planning	Planning at four interceptor construction contracts.
Design/CS/RI	Design, resident inspection, and construction services four interceptor construction contracts.
Construction: Mystic Valley Sewer Section	Replacement of 4,250 linear feet of the existing 1.25 feet diameter sewer located on the upper end of the Mystic Valley Sewer in Woburn with a two feet diameter sewer.
Construction: Revere Branch Sewer Section	Installation of 3,500 linear feet of four feet diameter sewer parallel to the existing four feet diameter sewer. Section 62 extends from, Crescent Avenue to Mill Creek in Revere.
Construction: Cambridge Branch Sewer Sections 23 through 25	Installation of 4,935 linear feet of six feet diameter relief sewer parallel to the existing 6.76 feet diameter sewer. The interceptor branches out from the North Metropolitan Sewer, extending along Route 99 to the Charlestown Pump Station.
Construction: Malden Branch Sewer Sections 65 and 66	Replacement of 2,630 linear feet of existing 1.5 feet diameter sewer with a new two feet diameter sewer. The existing sewer runs along Route 99 between Taylor and Salem Streets.


System Master Plan
Interceptors
WOBURN
STONEHAM
LYNN
Mystic Valley
Sewer
SEC. 153
MELROSE
SAUGUS
WINCHESTER
MALDEN
SEC. 65
Malden
Branch Sewer
SEC. 66
MEDFORD
REVERE
ARLINGTON
EVERETT
SEC. 62
Cambridge
Branch
Sewer
SEC. 23-25
BELMONT
CHELSEA
SEC. 61
Revere
Branch
Sewer
SOMERVILLE
CAMBRIDGE
WINTHROP
WATERTOWN
East
Boston
Boston
Main
Brighton
Roxbury
South
Boston
BROOKLINE
BOSTON
Dorchester
West Roxbury
Hyde
Park
Neponset
Valley Sewer
SEC. 15-21
QUINCY
DEDHAM

Corrosion and Odor Control Study (132)

Purpose

High sulfide levels in the Framingham Extension System are believed to cause corrosion and odors in that system and downstream in the Wellesley Extension Sewer System. The study will identify the causes of corrosion and odors and recommend corrective measures. It will also provide detailed information about the local sewers in Ashland and Framingham, which will be used in assessing the feasibility of the Ashland Extension Sewer Project.

Project History and Background

Sewer odors produced by hydrogen sulfide,affect the structural integrity of pipes and pump stations, as well as community relations. Recent collapses in the Framingham Extension Sewer (FES) have alerted staff to problems in that area. Odor complaints have been received from residents abutting both the FES and the Wellesley Extension Sewer (WES) systems resulting in legal claims totaling several hundred thousand dollars.

This situation prompted staff to experiment with adding odor control chemicals at various points in the local systems and FES to try to reduce the levels of odor due to hydrogen sulfide. The results were mixed; not all of the chemicals were effective even over the short term, and none completely eliminated hydrogen sulfide. Chemicals used have included potassium permanganate, hydrogen peroxide, two types of calcium nitrate, and ferrous chloride, with costs ranging from $1,000 to $2,000 per day.

While MWRA attempts to minimize odor impacts through chemical intervention and sealing locations where odors escape, a more permanent solution is being sought. MWRA believes that high sulfide levels in the FES system are a major contributing factor to the corrosion and odors existing both in the FES and downstream in the WES system. There is speculation that the sulfide levels originate in tributary municipal sewerage systems and transfer into MWRA's interceptors.

Scope

Subphase	Scope
Planning/Design	Identification of causes and sources of odors; collection of local sewer system information in Ashland, Natick, and Framingham; recommendations for long-term corrective measures.

Wastewater Facilities Rehabilitation (133)

Purpose

Systematic repairs and rehabilitation of wastewater facilities are critical to ensuring the safe and efficient operation, and to avoiding the greater capital costs of complete replacement of badly deteriorated facilities.

This project consists of three phases designed to meet this need. The first phase involves development of a comprehensive inventory and evaluation of 23 facilities. Rehabilitation projects will be identified, scheduled, and constructed according to need, over the next 20 fiscal years.

MWRA engineering and operations staff coordinate current rehabilitation projects with those identified under this project. All rehabilitation will be incorporated into the baseline information for each facility.

Project History and Background

The Sewerage Division Plan evaluated the condition of the system's interceptors and facilities, and identified general maintenance and rehabilitation needs. The Wastewater Facilities Rehabilitation project will focus in greater depth on 23 facilities, including six CSOs, six pumping stations, one screen house, three headworks, the Clinton Wastewater Treatment Plant, and six miscellaneous structures. Facilities planned to be abandoned will not be included in this project. As part of this study, a comprehensive facility inventory will be compiled and subsequently used by staff for short- and long-term maintenance planning.

Scope

Subphase	Scope
Inventory and Evaluation	Production of a comprehensive inventory (building components and equipment) of each of the division's 23 existing facilities, and identifications of deficiencies requiring attention within the next 20 years.
Design	Design of a program to set priorities for work identified during the Inventory and Evaluation phase
Construction	Rehabilitation of the facilities chosen in the Design phase.

West Roxbury Tunnel Study (135)

Purpose

To conduct a study of the condition of the West Roxbury Tunnel sewer. This sewer, built in 1964, transports flows from the Wellesley Extension Relief Sewer System through the West Roxbury portion of Boston to the high level sewer. A structural failure could result in surcharging and overflows. Following the investigation through video and visual inspections, a consultant will develop recommendations and estimate the cost of rehabilitation, if necessary.

Project History and Background

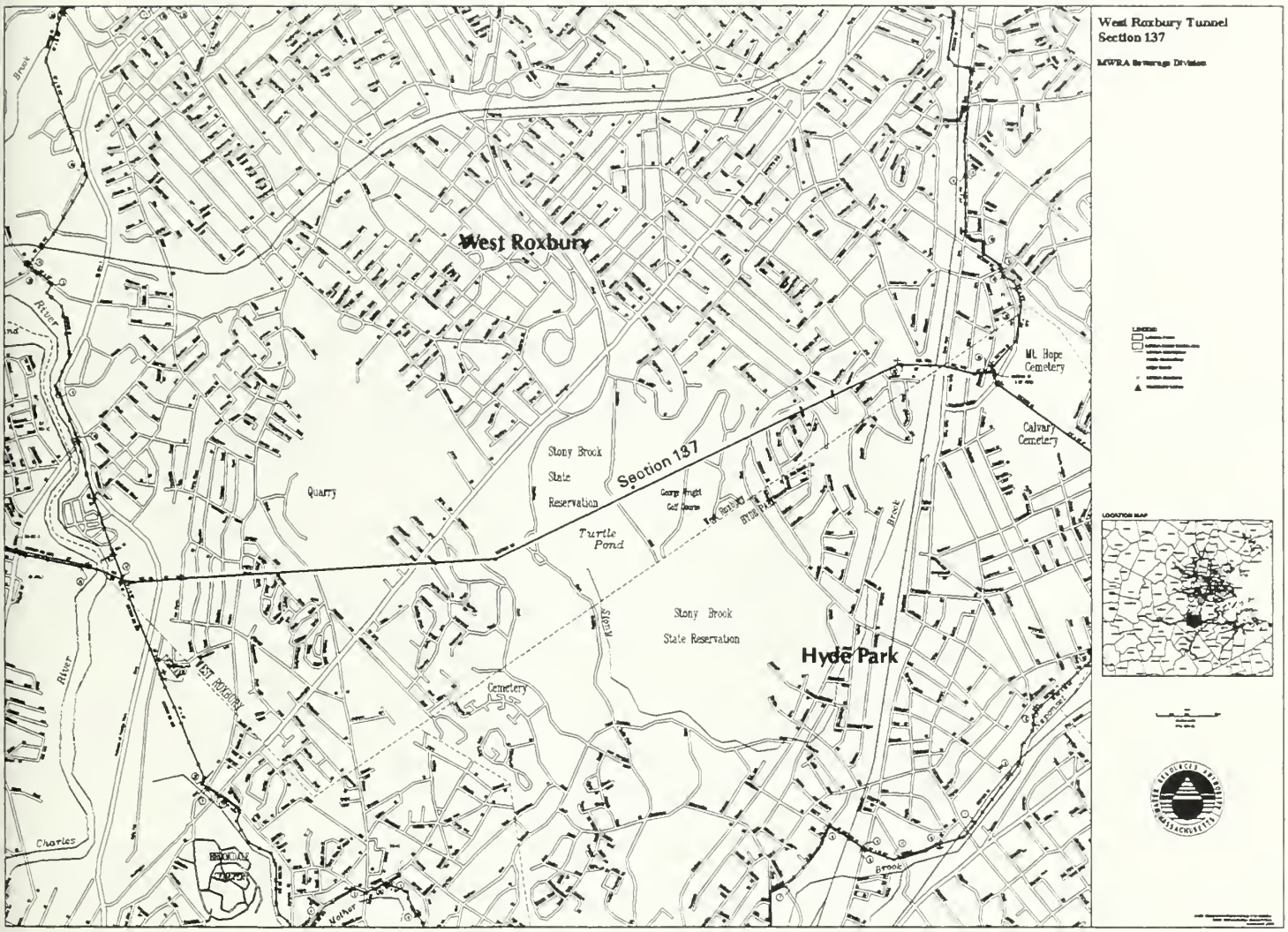
During the construction of the Wellesley Extension Sewer Replacement (WESR) Project, visual observations by MWRA's resident inspector indicated that severe corrosion had occurred in a portion of the Wellesley Extension Relief Sewer (WERS) directly upstream of the West Roxbury Tunnel (WRT). The report indicated that sections of the pipe and tunnel entrance structure had lost cement lining, exposing the reinforcing steel. Manholes and other structures had been affected more severely.

A structural failure of the WRT would affect the tributary communities of Ashland, Brookline, Dedham, Framingham, Natick, Needham, Newton, Wellesley, and the Hyde Park and West Roxbury portions of Boston. Local failure of the tunnel could result in the discharge of 53 to 128 mgd of raw sewage into the Charles River until emergency repairs could be made. Depending on the location of the failure, this volume of sewage could back up into local residences and businesses. In addition, service to 125,000 people would be interrupted because there is no redundant line with adequate capacity. The West Roxbury Tunnel also crosses beneath the VFW Parkway, Washington St., and a Conrail line. Structural failure beneath any of these major transportation corridors would result in a severe public safety hazard.

Because the problem is structural, any CSO or I/I improvements will not affect the need for this project.

Scope

Subphase	Scope
Inspection	Inspection of Section 137 of the West Roxbury Tunnel, which includes 12,500 linear feet of 84-inch reinforced and unreinforced concrete tunnel.
Engineering Report	Evaluation of Section 137, and development of recommendations and cost estimates for addressing structural deficiencies identified during inspection.


West Roxbury Tunnel
Section 137
MWRA Sewerage Division
West Roxbury
Section 137
Stony Brook
State
Reservation
Turtle
Pond
Quarry
Mt. Hope
Cemetery
Calvary
Cemetery
Stony Brook
State Reservation
Hyde Park
Cemetery
Charles
River
Brook
LOCATION MAP

Wastewater Central Monitoring and Operations (137)

Purpose

To study the feasibility of implementing an automated system to allow MWRA staff to monitor and control operation of the wastewater transport system from a central location. Transport facilities are currently operated independently by on-site operators, and MWRA does not possess the ability to gather, analyze, and respond to transport system performance information, or the ability to remotely implement synchronized responses to problem situations. The study will recommend a phased, cost-effective implementation framework.

Project History and Background

Wastewater transport facilities, including pump stations, CSO facilities and headworks facilities, are currently operated independently by on-site staff. This mode of operation does not provide MWRA with centralized and timely system performance information, nor the ability to remotely implement synchronized responses to problem situations. Without a centralized system, personnel are dispatched to unstaffed facilities as needed and facility operations are coordinated via telephone and radio.

In addition to improving the performance of the existing transport system, a central monitoring system will provide maintenance staff with information on the operating characteristics (e.g. vibration level, temperature) of key pieces of equipment within each facility. This data will allow maintenance staff to schedule and perform preventive maintenance, reducing service disruptions and preventing the need for more costly repairs.

As part of the recent Facilities Maintenance Benchmarking Project, Sewerage Division staff visited a wastewater district with a monitoring and control system in place similar to that proposed for MWRA. The wastewater district that was visited was observed to have a higher percentage of maintenance to operational staff, due to the use of their monitoring and control system.

From the visit, staff concluded that by eliminating the need for continuous staffing at many facilities, more staff resources could be made available for maintenance functions, resulting in a more extensive overall maintenance program and extended useful life of MWRA assets.

The FY99-01 CIP includes funds for the first phase of this project. The scope includes defining the needs, performing peer reviews of comparable agencies, analyzing alternatives, and developing a recommended implementation plan.

Scope

Subphase	Scope
Planning	Development of an implementation plan for a monitoring, control, and coordination system for the MWRA wastewater transport system. The plan will define the system functionality (but not final design) and a strategy for implementation.

Archdale Road Diversion Structure (139)

Purpose

Construction of a diversion structure will permit diversion of up to 150 mgd from the High Level Sewer (HLS) to the City of Boston's Stony Brook Conduit (SBC) during severe rainstorms to prevent or mitigate overflows.

Project History and Background

On October 20, 1996 a 100 year rainstorm caused the MWRA high level Sewer (Section 70) to overflow in the area of Archdale Road in Boston. Following this overflow event, MWRA established a task force to review the event and recommend action to mitigate and/or prevent future overflows.

The task force developed an emergency response plan and examined several relief plan alternatives. The recommended relief plan consists of construction of a diversion structure which will consist of seven 24-inch diameter pipes, averaging 30 feet in length, connecting the HLS to the SBC. The pipes will be controlled by seven valves located in a chamber adjacent to the HLS. The diversion structure will extend from the HLS to the Stony Brook Conduit at the end of Bradeen Street in Roslindale.

If, based upon monitoring, it appeared that the High Level Sewer was about to overflow in the Archdale Road area due to an extraordinary storm event, the overflow volume would be diverted to the Stony Brook Conduit through permanent underground pipes. This would eliminate the need to deploy large emergency response crews to build temporary sandbag dikes. Through hydraulic analysis it was determined that the cross sectional area of seven 24-inch diameter pipes was necessary to provide adequate hydraulic relief for the High Level Sewer if storm comparable to the October 1996 storm were to occur again. Each pipe included its own gate valve to control not only when relief was to occur but also the rate of discharge. MWRA completed the final design (plans, specifications, survey) for this relief alternative in January 1998 and provided the construction documents to Boston Water Sewer Commission for their review and comments.

BWSC commented that the design appeared to be too complex and costly and suggested a simpler design concept be evaluated. In February 1998, MWRA commissioned Green International to evaluate MWRA's original design, as well as three alternative designs developed from BWSC's suggestions. Green International concluded that an alternative design consisting of two horizontal sluice gates could be substituted for MWRA's original seven pipe design with a cost savings of approximately $200,000 to $300,000. Green International was directed by MWRA to immediately commence detailed design of the new design concept. Design should be completed by late summer with construction scheduled to commence in Fall 1998.

Scope

Subphase	Scope
Design	In-house design.
Construction	The project will consist of construction of seven 24-inch diameter ductile iron pipes averaging 30 feet in length and connecting the HLS to the SBC. The pipes will be controlled by seven valves located in a chamber adjacent to the HLS.

Non-BHP Treatment

Purpose

This subset of the Treatment program category will ensure the proper and efficient operation of the new Deer Island Treatment Plant, meet regulatory requirements, and protect the new facility's assets. Several phases of the $3.7 billion Boston Harbor Project were complete and operational by the end of FY97. Specific projects will provide for technological or operational improvements, rehabilitation or repairs, equipment replacement, and protection of plant assets.

Project History and Background

Construction of the $3.7 billion Deer Island Treatment Plant is currently administered by the Program Management Division as part of the Boston Harbor Project. Following completion and acceptance of a facility or a construction package by MWRA, the responsibility for operating the facility transfers to the Sewerage Division. To ensure proper and efficient operation of the facility, new projects are needed for technological or operational improvements, rehabilitation or repairs, and general protection of the plant's assets.

The following projects provide an array of services and capital improvements to support the transition from initial construction. Deer Island management will use these services to complete unanticipated, emergency, or high priority repair, modification, and maintenance projects at the new Deer Island Plant which meet CIP policy guidelines for capital projects.

To date, MWRA has placed $1.5 billion in new wastewater treatment facilities into operation. On January 20, 1995, MWRA introduced wastewater into the first two primary treatment batteries (A and B) of the new plant. The remaining two primary treatment batteries (C and D) were completed in July 1995 and placed into service in September 1995.

In late July 1995, the first module of the new residuals treatment facilities was completed and steps to begin operation initiated. Transition to the new residuals complex proceeded more quickly than anticipated and it was in full operation by mid-August. At this point, the residuals facilities of the existing plant were taken off-line; the interim connection to the new plant was severed; and full-scale demolition of the existing plant began. The second module of the residuals facilities was completed in November 1995.

The first two of the three chemical storage tanks were completed and placed into operation in June 1995, and the interim storage tanks used to support the January plant start-up were removed. The third storage tank was completed in July 1995. The disinfection basins in the Phase II disinfection facilities (CP-241) were completed and placed into operation on December 15, 1995. The basins improve disinfection by increasing contact time with the sodium hypochlorite solution before effluent is discharged and may facilitate reduced chemical use.

After cut-over of the cross harbor cable from the interim substation to the permanent substation in October 1994, the 18 portable generators remained on-site to serve as the back-up power source for both the new plant and ongoing construction activity. By May 1995, the combustion turbine generators (CTGs) had been installed and sufficiently tested to serve as the permanent back-up power source, and the temporary generators were removed. Performance testing was completed in August 1995, and the CTGs were turned over to DITP.

The first Secondary treatment battery began operations in August 1997, and the diversion of South System flows through the Nut Island Headworks to the DITP began in July 1998.

The final BHP major components, Secondary Reactor and Clarifier Battery C and Final Site Completion are scheduled for completion in October 1999 and October 2001, respectively.

See the project description for the Deer Island primary and Secondary Treatment Facilities project in the document for a more detailed description of the overall facility and the treatment process.

Remote Headworks Rehabilitation (179)

Purpose

To improve the three remote headworks to ensure effective operation and safe working conditions for employees, and to extend the useful lives of these facilities.

Project History and Background

The remote headworks are located at Chelsea Creek in Chelsea, Columbus Park in South Boston, and Ward Street in Roxbury. These facilities provide pretreatment of the North System's sewage prior to its entering the Deer Island tunnel system. The three headworks facilities were built in the 1950s and 1960s. Rehabilitation begun in 1987 resulted in extensive improvements, but did not address all the problems at the headworks.

Additional improvements are necessary to address the following:

- Exterior paving in need of repair due to cracking, pot holes, and improper sloping for drainage (completed).
- Headworks tile floors which are worn and have missing and uplifted tiles which create safety hazards (completed).
- Broken, stained, or missing suspended ceiling panels (completed).
- Corroded grit hoppers which are no longer capable of safely storing grit (in construction).
- Emergency generators which are undersized for the operation new equipment installed during the 1987 rehabilitation, and cannot provide enough power to operate the HVAC systems during electrical shutdowns (in construction).
- Lack of toilet and locker facilities for female employees (in construction).
- Lack of proper ventilation (completed; part of Deer Island fast track improvements in 1990).
- Gratings at all three facilities which are either loose, bent, or twisted, creating tripping hazards (in construction).
- Guard rails which are only 37 inches in height, lower than the standard 42-inch rail height required by the Occupational Safety and Health Act (in construction).
- Freight elevators which have been in use for more than 20 years and are in need of repair to ensure safety and compliance with current Massachusetts codes (in design).

Scope

Subphase	Scope
Rehabilitation Design/CS 1	Design and construction services for Rehab-Construction 1 phase.
Rehabilitation-Construction 1	Installation of new paving at Columbus Park and Ward Street, new suspended ceiling systems at the Chelsea Creek and Ward Street facilities, and new tile flooring in the operations rooms, lunch areas, and locker rooms at the Chelsea Creek and Columbus Park facilities.
Rehabilitation-Design 2/RI	Design for Rehab-Construction 2 phase.
Rehabilitation-Construction 2	Installation of direct discharge piping to RO/RO containers.
Rehabilitation CS/RI 2	Construction services and resident inspection for Rehab-Construction 2 phase.
Rehabilitation Design 3	Design for Rehab-Construction 3 phase.
Rehabilitation Construction 3	Installation of properly-sized generators, switchgear, and transfer switches; construction of female locker, shower, and restroom facilities; and replacement of grating and railings at all three facilities.
Rehabilitation CS/RI 3	Construction services and resident inspection for Rehab-Construction 3 phase.
Technical Assistance	Technical Assistance for emergency generators, female locker facilities, grating, and guard rails.
Elevator Rehab-Design	Design for Elevator Rehab-Construction phase.
Elevator Rehab-Construction	Freight elevator shaft repairs and replacement or modification of the head house structure, operating mechanism, controls, and cab.

Boston Harbor Performance Certification (198)

Purpose

Performance certification for the Boston Harbor Project (BHP) is required by funding agencies to maintain project eligibility for federal and state grant and loan programs. As defined by this project, operational Phase I of the BHP was completed in FY96; written certification for this phase was completed in FY98. Certification of Phase II is to begin in FY99.

Project History and Background

Performance certification, an independent evaluation of a project's ability to satisfy specific performance standards, is generally a requirement of state and federal grant funding and loan programs. If the facilities meet performance standards, they are certified. If the facilities do not meet performance standards, corrective action is required before the final release of grant funds. Certification of the new Deer Island Treatment Plant's performance will furnish the MWRA with an independent evaluation of the equipment and system's ability to function as designed. It will also give extra assurance that the design, construction, and operation have interfaced effectively to produce a functional plant.

BHP consists of many interrelated components that cannot be evaluated independently. Therefore, evaluation will be performed on groups of projects after they have reached substantial completion and have operated for a period of time. Certification will be performed over three operational phases by a single, independent consultant using data generated by the Deer Island Treatment Plant, Environmental Quality Department, Lead Design Engineer, Project Design Engineer, Construction Manager, and the selected consultant.

Scope

Subphase	Scope
All Phases	Provision of expert, unbiased evaluation of the new Deer Island Treatment Plant's operating performance during and following each defined operational phase. Provision of project certification when performance standards are met. Assistance in the development of any corrective action plan deemed necessary. Provision of reports and back-up data to support conclusions.

Deer Island Ancillary Modifications (200)

Purpose

This project will provide an array of task order design construction resident inspection services. Deer Island management will use these services to complete unanticipated, emergency, or high priority repair or modification projects at the new Deer Island Treatment Plant. Staff will only use these resources to address plant operations or maintenance issues due to:

- problems that require immediate attention in facilities accepted by MWRA and under the operation of the Sewerage Division;
- problems or projects that are identified after the first year of operation by MWRA;
- problems identified as warranty-related matters that contractors refuse to address or delay in addressing; and,
- MWRA-determined design changes that will result in operational benefits.

Project History and Background

The new Deer Island Treatment Plant, the centerpiece of the Boston Harbor Project, consists of an extensive infrastructure of facilities and utility services. Due to the size, scope, and complexity of the BHP, it is inevitable that unanticipated repairs and/or modifications to various facilities and utilities will be necessary following substantial completion and eventual turnover to the Sewerage Division. These contracts are not intended for use in addressing routine and anticipated plant operations and maintenance.

Scope

Subphase	Scope
Construction - HVAC	Provision of construction labor to address heating, ventilation, and air conditioning (HVAC) issues.
Construction - Plumbing	Construction labor to address plumbing issues.
Construction - Electrical	Construction labor to address electrical issues.
Construction - Site Work	Construction labor to address site work issues.
Supplementary Modification Pkg. #1	Construction support labor for modification projects, in addition to current CSC contracts
Design/CS/RI	[Add desciption from previous project HERE]
Ancillary Modifications Design (CP 212)	Scope of work from former BHP contract. Includes NMPS sump pumps, Primary Clarifier chain replacements, and several improvements for the Secndary Batteries and Residuals Treatment facilities.
Ancillary Modifications Construction (CP 212)	Scope of work from former BHP contract. This subphase is for construction of items listed above.

Deer Island Sodium Hypochlorite Facility (201)

Purpose

To build a facility on Deer Island to generate sodium hypochlorite. On-site generation appears to offer a less expensive and more reliable alternative to purchasing the chemical through a multi-year contract.

Project History and Background

Sodium hypochlorite is the primary chemical used in the disinfection and odor control processes at the Deer Island Treatment Plant. Several years ago, Deer Island experienced a serious interruption in sodium hypochlorite delivery services when the vendor encountered barging difficulties.

During this two week interruption, Deer Island management arranged on an emergency basis for delivery of sodium hypochlorite via trucks, exceeding the limits in MWRA's Memorandum of Understanding with Winthrop regarding the number of trucks and cargo allowable through Winthrop to D.I. In the future, severe weather in Boston Harbor could again hinder the delivery of this vital chemical and thus jeopardize the ability of the DITP to meet permit requirements unless MWRA has the capability to produce sodium hypochlorite on-site.

In 1994, Deer Island staff began a study of the feasibility and cost-effectiveness of on-site generation of sodium hypochlorite. This study, which has been completed, included review of various technologies for generating sodium hypochlorite and an analysis of the costs and issues associated with each technology. Staff have also completed life cycle cost analyses (LCCA) for numerous scenarios, primarily to account for a range of assumptions for production volumes, energy prices, useful life of the facility, and potential changes in regulations regarding disinfection.

The results of the most recent LCCA for this project indicate that on-site generation of sodium hypochlorite is less expensive long-term than purchasing the chemical through a multi-year contract. Also, the new generation facility will ensure that sodium hypochlorite will be consistently available for use in the treatment process. The facility will be located in the area of the existing sodium hypochlorite tank farm and will require demolition of two of the tanks.

Scope

Subphase	Scope
Design/CS/RI	Design and construction administration for construction of plant.
Construction	Construction of plant.

Deer Island Coastal Protection (202)

Purpose

Pursuant to the Massachusetts Wetlands Protection Act, MWRA is required to ensure coastal protection of Deer Island. This includes restoring any shoreline area damaged by weather or the construction of seawalls and revetments to limit the DITP's exposure to adverse weather.

Project History and Background

As part of the Boston Harbor Project, seawalls and revetments will be constructed to limit the new Plant's exposure to adverse weather conditions. Per the Massachusetts Wetlands Protection Act, MWRA is responsible for restoring any shoreline area damaged during the construction of seawalls and revetments.

To quantify the construction impacts, MWRA will survey the shoreline prior to construction to develop a baseline and benchmarks for comparison with post-construction conditions.

The beach areas to be considered include: the northeastern shoreline affected by the CP-204 seawall and the CP-043 revetment, and the southeastern shoreline adjacent to the CP-301 seawall. Annual surveys of these areas include vertical aerial photography of the eastern and northern shores, developing profiles based on beach measurements, and obtaining storm effect data from the National Weather Service and town and newspaper.

Two, five, and ten years from the pre-construction survey, a consultant will determine the extent of beach erosion, if any. If erosion has exceeded any thresholds set for the beach areas, the beach will be restored back to the baseline level. The restoration limits extend from the seawall or revetment down to mean low water (MLW) or mean seal level (MSL).

Scope

Subphase	Scope
Coastal Protection	Restoration of Deer Island shoreline if damaged by the weather or construction of the seawall and revetments.

Deer Island Plant-Wide System (203)

Purpose

The current method for evaluating mechanical failures or preparing for equipment down time at the Deer Island Treatment Plant is time consuming. Information from many paper references must be collected and reviewed in order to develop a complete understanding of mechanical and system interdependencies.

By regrouping data, a plant-wide computer system will allow plant engineers to more efficiently facilitate the repair and maintenance of mechanical systems. The plant-wide system under consideration will provide immediate access to important drawings and related documents at the personal computers of engineering, operations, and maintenance staff.

Project History and Background

Staff-originated documents, in various stages of revision, are normally required for reference when performing maintenance, repairs, replacements, or modifications at the Deer Island Treatment Plant. The gathering and review of these documents is critical in developing a complete picture of mechanical and system interdependencies.

This data collection process is time consuming and affects the response rate in responding to mechanical failures at the DITP.

A plant-wide system will allow engineering, operation and maintenance staff to immediately access important drawings and related documents on personal computers. Access to such a system will reduce the need to possess expertise in one particular area of the plant, expeditiously identify system or equipment relationships, and account for and controls all work performed.

Scope

Subphase	Scope
DISC Application	Provision of hardware, software, and contract services to implement a Deer Island plant-wide system.

Deer Island Maintenance Warehouse (205)

Purpose

To optimize the existing Deer Island facilities to accommodate additional needs for vehicle and equipment storage and the storage of hazardous materials.

Project History and Background

Staff have revised the estimates for additional warehouse space based on a 1995 study completed as part of DP-40, and an evaluation of the future available space included in the 1994 FRSA Development Plan. Based on these evaluations, staff project the need for a much more limited scope of work. A presentation to the Board on the updated plan will likely occur in the fall. Major project components will likely include:

- enhanced interior storage/rack/cabinet systems
- exterior pipe storage shed
- exterior storage for vehicles/equipment
- hazmat storage
- sand/salt shed storage
- minor building addition for equipment maintenance

Scope

Subphase	Scope
Design	As described above.
Construction	As described above.

Deer Island Equipment Replacement (206)

Purpose

To plan and implement an equipment replacement program for the Deer Island Treatment Plant to replace equipment and systems to maintain uninterrupted plant performance. The first equipment replacement cycle is anticipated to begin in FY 2000.

Project History and Background

Unanticipated equipment and system failures have the potential to cause operational, maintenance, and budget crises. Prudent industry practice attempts to minimize such crises by establishing programs to anticipate when equipment and systems approach the end of their reliable service lives.

The intent of the equipment replacement program is to provide for the implementation of a plan which efficiently and strategically manages the replacement of systems and the annual expenditures required to support the Deer Island Treatment Plant and maintain discharge permit compliance.

The first phase of the project, an equipment replacement study, will be comprised of three phases:
- -Equipment and System Life Cycle Projection
- -Reliability Centered Maintenance Assessment
- -Implementation Plan

The first phase of the study will evaluate plant process equipment and systems and establish practical life cycle projections based on review of their usage, warranty information, and operating environment. The life cycle projections will aid in plant operation and maintenance planning and will allow for the preparation of long term budgetary projections for fiscal planning. In the second phase, the Reliability Centered Maintenance program will assess and prioritize plant equipment and employs a "just in time" replacement approach. The final study phase will develop a maintenance plan to include equipment and systems prioritized by the plant wide reliability centered maintenance evaluations.

The cost of both the study and equipment replacement will be funded by current revenues rather than bond proceeds, because of the on-going maintenance character of these expenditures.

Scope

Subphase	Scope
Study	Develop a strategic plan based on risk assessments and estimated useful lives of equipment at DITP.
Equipment Replacement	Ten year program for replacement of mechanical, electrical, and process systems required to maintain plant performance.

Deer Island Demineralizer System Improvements (207)

Purpose

To enable staff to more precisely monitor and control chemical usage in the demineralized water system and enhance operator safety, MWRA plans to install chemical day tanks and additional chemical piping.

Project History and Background

The demineralizer system provides make-up feed water for the thermal power plant boilers and attemperating water for pollutant emissions control for each of the combustion turbine generators (CTGs). The demineralizer system is designed to produce 120 gallons per minute (gpm) of water. This would be the required amount of demineralized water to support the power plant at its peak capacity. The power plant's peak capacity has been sized to support the DITP in the event of a loss of the utility source of power.

Problems with the quality of the water processed by the demineralized water system are largely due to the intermittent use of the system, which was unanticipated at the time of design and construction.

The demineralizer system is currently producing water of marginal but passable quality at 1/3 design flow. This 1/3 design flow arrangement will not support the power plant at its peak power production capacity.

Scope

Subphase	Scope
Design	Design of the installation of chemical dry tanks and additional chemical piping for the thermal power plant's demineralized water component.
Construction	Construction of the above components.

Deer Island Primary and Secondary Treatment Facilities
(182)

Purpose

The Massachusetts Water Resources Authority is constructing a wastewater treatment plant and related facilities to minimize the pollution of Boston Harbor. The new Deer Island Primary and Secondary Treatment Facilities are the largest components of the Boston Harbor Project (BHP), an 11-year, $3.5 billion effort started in 1988 to comply with the requirements of the federal Clean Water Act and to improve the harbor for recreational and commercial uses.

Project Scope

Prior to start of the project, 43 cities and towns in metropolitan Boston transported sewage to MWRA's two outdated primary sewage treatment plants which discharged 500 million gallons of poorly treated wastewater to the harbor each day. In addition, 500,000 gallons of processed sludge were discharged daily to the harbor on the outgoing tide. These discharges, plus the untreated wastewater that flowed into the harbor from combined sewer overflows, made Boston Harbor among the most polluted bodies of water in the nation.

The Boston Harbor Project is the second largest public works project ever undertaken in New England. The centerpiece of the project is the construction of the new primary and secondary treatment plant on Deer Island. When completed in 2000, the plant will be the second-largest sewage treatment plant in the nation.

MWRA is carrying out the BHP under a federal court order issued by U.S. District Court Judge A. David Mazzone. In December 1982, the City of Quincy filed suit in Massachusetts Superior Court, charging that wastewater discharges to Boston Harbor were in violation of the federal Clean Water Act of 1972, which requires secondary treatment of wastewater discharges. Judge Mazzone ordered the construction of the new primary and secondary facilities and, on May 8, 1986, issued a timetable for the project.

On June 16, 1993, MWRA submitted a report to the Federal Court which focused on efforts to reevaluate the scope of the project to achieve compliance with environmental requirements in the most cost-effective manner. The report outlined a strategy for development of steps that might lead to significant project savings, including savings on the secondary treatment plant.

The Secondary Treatment Facilities Plan, completed in 1988, called for four batteries to handle the

wastewater flows and pollutant loads projected for the 30-year planning period, based on information available at the time. Since that time, a study has been completed which determined that all four batteries are not needed to meet Clean Water Act requirements for providing secondary treatment. Judge Mazzone has approved MWRA's recommendation to eliminate Battery D and related facilities from the design of secondary treatment for Deer Island. MWRA removed the costs associated with Secondary Reactor and Clarifier Battery D and Residuals Facilities Phase II from the FY96-98 CIP.

Construction of the new primary plant began in 1990. The court schedule called for half of the primary plant to be completed by mid-1994, with the entire primary plant completed and operational by mid-1995. MWRA began operation of the first phase of the new plant in January 1995. Batteries C and D and the first module of residuals were completed in July 1995. Construction of the secondary plant began in late 1992, and the third Battery is scheduled for completion in 1999.

Treatment Plant Operations

The new plant provides state-of-the-art primary treatment, which removes 55 percent of solids and reduce biochemical oxygen demand (BOD) by 35 percent. Secondary treatment will further purify the wastewater, removing 85 percent of solids and 50 to 90 percent of toxins. Biochemical oxygen demand will be further reduced to a total of 85 percent.

Sewage from MWRA's 43 communities delivered to the new plant from several headworks, which screen out large objects that would damage equipment. Wastewater from the 22 communities in MWRA's North Collection System travels to the Deer Island plant through two existing deep-rock tunnels under the harbor, and through the North Metropolitan Sewer in East Boston and Winthrop. Sewage from the 21 cities and towns in MWRA's South Collection System will receive grit and screening removal at the new Nut Island headworks in Quincy before flowing to Deer Island through the 4.8 mile cross-harbor tunnel MWRA is constructing as part of the project.

Wastewater from the North Collection System arrives at the Deer Island North Main Pump Station/Winthrop Terminal Facility (NMPS/WTF). Following completion of the cross-harbor tunnel, Wastewater from the South Collection System will be transported to the South System Pump Station (SSPS). Wastewater is then pumped to primary clarifiers or sedimentation tanks, where it is retained for one to two hours. During that time, most of the heavier suspended solids settle to the bottom of the tanks. There, plow-like scrapers move the solids to a sump or hopper at the entry end of the tank where they are drawn out of the bottom of the tank. These solids, called primary sludge, are pumped to gravity thickeners and ultimately to digesters in the residuals area for further treatment.

Secondary treatment will use aeration tanks to create a highly controlled environment in which microorganisms, naturally present in wastewater, will consume suspended solids in the primary effluent. Oxygen will be added to encourage rapid growth of these helpful microorganisms. As a

result, suspended solids will be converted to heavier solids. After about two hours, the mixture of wastewater and microorganisms will flow to sedimentation tanks, or secondary clarifiers, similar to those used during primary treatment. There microorganisms and other suspended matter will settle to the bottom.

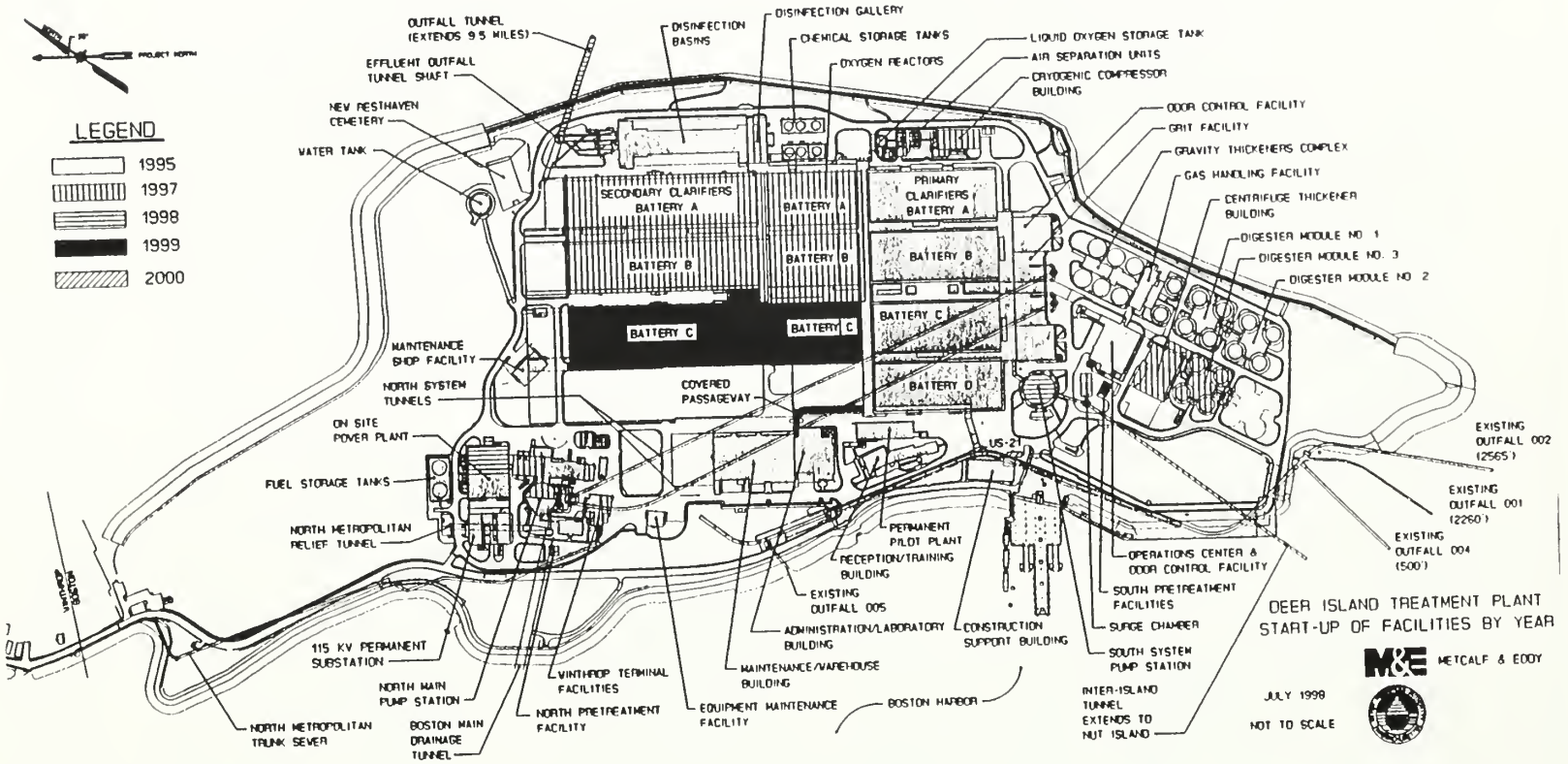
Most of the settled sludge, which contains a high concentration of microorganisms, will be recycled to aeration tanks to perpetuate the biological process. The excess material, not necessary for maintaining the biomass, is called secondary waste activated sludge (WAS) and will be removed from the process and pumped to the residuals area.

The secondary sludge will be thickened in centrifuges to decrease its liquid volume. The primary and thickened waste activated sludge will then be blended and biologically stabilized in sludge digesters for at least 15 days to further decrease volume, and remove odor and kill disease-causing organisms. The sludge will then be processed through additional centrifuges to remove some of the remaining liquid to further decrease volume. The thickened sludge will be shipped by barge to the Fore River Staging Area in Quincy where it will be converted to fertilizer pellets through a heat-drying process.

At the end of the treatment process, the remaining wastewater will be disinfected with sodium hypochlorite to kill any remaining disease-causing organisms. Provisions have also been made for dechlorinating the effluent with sodium bi-sulfite, if studies find that the process is required. The treated effluent will then be discharged to the ocean through the 9.5-mile effluent outfall tunnel, where it will be released in deep water through 55 diffusers to ensure thorough mixing of the treated effluent with seawater.

Project Management

MWRA established the Program Management Division (PMD) to manage the design and construction of the new treatment facilities. PMD is assisted by two consultant teams: the Construction Manager (CM) and the Lead Design Engineer (LDE). In June 1990, the Board of Directors approved a five-year contract for a Construction Management (CM) Services Team, to be led by ICF Kaiser Engineers, Inc., for the period from January 1991 to December 1995. The contract included three three-year options for extension, the first of which has been exercised to continue CM services and resident inspection from January 1996 through December 1998. Metcalf and Eddy was awarded the five-year LDE contract in August 1988. The contract was subsequently extended to December 1995 and then to July 1998.


LEGEND
1995
1997
1998
1999
2000
PROJECT NORTH
OUTFALL TUNNEL (EXTENDS 9.5 MILES)
EFFLUENT OUTFALL TUNNEL SHAFT
NEW RESTHAVEN CEMETERY
WATER TANK
DISINFECTION BASINS
DISINFECTION GALLERY
CHEMICAL STORAGE TANKS
OXYGEN REACTORS
LIQUID OXYGEN STORAGE TANK
AIR SEPARATION UNITS
CRYOGENIC COMPRESSOR BUILDING
ODOR CONTROL FACILITY
GRIT FACILITY
GRAVITY THICKENERS COMPLEX
GAS HANDLING FACILITY
CENTRIFUGE THICKENER BUILDING
DIGESTER MODULE NO. 1
DIGESTER MODULE NO. 3
DIGESTER MODULE NO. 2
SECONDARY CLARIFIERS BATTERY A
BATTERY A
PRIMARY CLARIFIERS BATTERY A
BATTERY B
BATTERY B
BATTERY B
BATTERY C
BATTERY C
BATTERY C
BATTERY D
MAINTENANCE SHOP FACILITY
NORTH SYSTEM TUNNELS
COVERED PASSAGEWAY
ON SITE POWER PLANT
FUEL STORAGE TANKS
NORTH METROPOLITAN RELIEF TUNNEL
US-2
EXISTING OUTFALL 002 (12565')
EXISTING OUTFALL 001 (12260')
EXISTING OUTFALL 004 (500')
PERMANENT PILOT PLANT
RECEPTION/TRAINING BUILDING
EXISTING OUTFALL 005
ADMINISTRATION/LABORATORY BUILDING
CONSTRUCTION SUPPORT BUILDING
OPERATIONS CENTER & ODOR CONTROL FACILITY
SOUTH PRETREATMENT FACILITIES
SURGE CHAMBER
SOUTH SYSTEM PUMP STATION
INTER-ISLAND TUNNEL EXTENDS TO NUT ISLAND
115 KV PERMANENT SUBSTATION
NORTH MAIN PUMP STATION
VINTHROP TERMINAL FACILITIES
MAINTENANCE/WAREHOUSE BUILDING
EQUIPMENT MAINTENANCE FACILITY
BOSTON HARBOR
NORTH METROPOLITAN TRUNK SEWER
BOSTON MAIN DRAINAGE TUNNEL
NORTH PRETREATMENT FACILITY
DEER ISLAND TREATMENT PLANT
START-UP OF FACILITIES BY YEAR
M&E METCALF & EDDY
JULY 1998
NOT TO SCALE

Site Facilities Construction

Purpose

The Site Facilities construction phase of the BHP consists of 19 construction contracts with an estimated total cost of $233.7 million. These contracts are needed to prepare the site for construction of the Primary and Secondary Treatment Facilities and to provide support facilities required for plant construction. A ten-year supply and delivery contract for concrete is included in this phase.

The following narrative provides descriptions for only active contracts in this phase. In cases where phases have multiple projects, only the remaining active phase is listed in the heading. However, the text may reference the completed phases.

Removal of Temporary Facilities (CP-042)

This contract funds the removal of the concrete batch plant foundation and other temporary facilities required during construction.

Western Shoreline Protection (CP-048)

The Western Shoreline Protection contract continues shoreline protection included in the Primary Residuals (CP-301), Disinfection Facilities (CP-204), and Late Site Preparation contracts (CP-043). This will complete the shoreline protection for all of Deer Island. This portion of shoreline protection is a mixture of revetment-type construction, consisting primarily of large rip rap and a mini-concrete seawall in some areas. It is needed to prevent erosion on the main access road along this shoreline and to protect major plant utilities under the roadway. This contract also includes removal of a temporary fuel facility and a temporary trash transfer facility.

Replacement of the Shirley Gut Siphon, located on the western shoreline of Deer Island, is included in the project budget.

Final Site Completion (CP-044)

The Final Site Completion contract includes development of the final land forms, construction of the north and east roadways, shoreline protection at a temporary fuel facility area, and all remaining landscaping. Removal of a temporary wheel wash facility, and the construction of a public docking facility and a permanent parking lot are included in this contract. Work under this contract will begin once permanent facilities are substantially complete. Commencement of work is anticipated in September 1998.

Supply and Delivery of Concrete (CP-905)

Construction of the treatment plant and the tunnels requires approximately one million cubic yards of concrete over a ten-year period. As part of a mitigation agreement with the Town of Winthrop, this quantity cannot be transported through the town. As a result, MWRA entered into a ten-year contract with a concrete supply firm to produce all the standard classes of concrete required for the project at the construction site. The mixing facility is located on-island because concrete must be placed in forms shortly after mixing and therefore could not be barged from an off-island plant. Each contractor must purchase concrete from this supplier.

The contract requires the supplier to barge all bulk concrete materials to the island, off-load at the bulk piers, and maintain a reserve of raw materials within a specified area. The supplier is required to produce up to 1,600 cubic yards per eight hour shift and to guarantee delivery to each of the contractors within the first six hours of the work day. Because concrete is such a significant component of the construction process, capacity and quality control are extremely important.

Each contractor enters into a contract with the supplier for supply and delivery of each type of concrete at a fixed unit price. The unit price is established to recover the concrete operator's cost of plant construction, operation, and demolition. Therefore, each sub phase budget includes an amount for the required quantity of concrete at its specific unit cost. The sub phase budgets do not provide for the plant operator's recovery of inflation related increases for labor and material. These inflation payments are included in CP-905. Since 1992, and continuing for the life of the contract, the MWRA has been making quarterly payments to the concrete plant operator for the higher costs, using an industry accepted inflation index.

Pretreatment and Primary Construction

Purpose

The Pretreatment and Primary Plant Construction phase includes 13 contracts for the construction of the inter-island tunnel, pretreatment facilities on Nut Island and Deer Island, primary transmission facilities, primary clarifiers, and ancillary primary plant facilities. Pretreatment and Primary Plant construction is estimated to cost $727.9 million.

The following narrative provides descriptions for only active and future contracts in this phase.

South System Pump Station (CP-104)

The South System Pump Station, located to the west of the North System Headworks, pumps screened and degritted wastewater from the Inter-Island Tunnel to the treatment facilities at Deer Island. Under normal operation, south system flows are discharged to the effluent channel in the pretreatment gallery of the North System Grit Facility, where it is combined with the degritted North System flows. The pump station includes eight 60-mgd raw wastewater pumps: six to handle peak flows, and two to provide back-up capacity.

Inter-Island Tunnel / Extended Outfall Protection (CP-151/031)

The Inter-Island Tunnel and shafts transport wastewater flows from Nut Island to Deer Island. This contract includes construction of a 4.8 mile concrete-lined deep rock tunnel measuring approximately 11.5 feet in diameter. A 16-foot diameter shaft on Deer Island and an 11-foot diameter influent tunnel to connect the Deer Island shaft with the South System Pump Station has also been constructed. Construction of a 16-foot diameter shaft on Nut Island, a 12-feet by 12-feet headworks effluent channel connecting the Nut Island shaft and headworks facility, and a 36-inch diameter stub pipeline for future connection with the Braintree-Weymouth tunnel system are also included in this contract.

In addition, twin 14-inch sludge pipelines will be embedded within the tunnel and the Deer Island shaft to allow pumping of sludge from Deer Island to the Fore River residuals processing facility starting in 2001. This contract also provides for construction of 1,500 linear feet of a reinforced concrete relieving slab to protect the existing outfall and junction chamber from construction equipment and truck traffic. A connection from the new bypass conduit to the existing plant outfall conduit was constructed. Protection of the existing conduit required drilling and placing 28,000 linear feet of piles, and relocation and protection of existing utilities. On November 4, 1995, operators of the tunnel boring machine broke through from the Inter-Island Tunnel to the Nut Island shaft, connecting the two islands. Substantial completion was declared on February 6, 1998.

Nut Island Headworks (CP-152)

The Nut Island Headworks screens out large objects and removes sand and other grit from the wastewater before the flow is conveyed through the Inter-Island Tunnel to the new primary treatment facilities.

This contract includes construction of the following components:

- Bar screens
- Grit separation chambers
- Odor control facilities
- Emergency generator
- Truck bays for removal of grit and screenings
- Operation and maintenance areas
- Administration area
- Headworks influent/effluent conduit
- Community historic room
- Water storage tank and fire pump
- Fuel oil storage tank for energy generators

All inter-connecting piping, electrical and control systems, plumbing fixtures, and related mechanical equipment are also included.

The existing Nut Island Wastewater Treatment Plant will remain in operation throughout the construction of the new headworks facility. In order to accomplish this, modifications and relocation of some of the existing facilities had to occur prior to the start of the headworks construction. Existing facilities affected by the location of the headworks facility include the pre-aeration basins, the generator wing of the main building, the gas control building, and approximately 300 feet of the plant influent and effluent conduits.

Modifications to the pre-aeration basin were substantial. Pre-aeration Basins No. 1 through 3 were demolished and all existing plant flows now pass through Pre-aeration Basin No. 4.

All of the existing treatment plant structures will be demolished after completion of the headworks facility. A passive park landscaped with trees, shrubs, and jogging paths will be constructed along the north and east shores. Overlooks and seating areas will be located on the east and west shores of the Island.

CP-170 Concrete Coating/Lining Repair and Upgrade Phase I
CP-171 Concrete Coating/Lining Repair and Upgrade Phase II

As a result of higher than anticipated concentrations of hydrogen sulfide in the influent system, there has been some deterioration of the concrete and concrete coating at several locations at Deer Island. The deterioration is primarily at the water line in various facilities and requires repair of the concrete and application of a new protective coating.

A combination of Linabond and a high epoxy coating is being used to cover the surfaces. It is estimated that less than 20,000 square feet of concrete is in need of repair at the new Deer Island Treatment Plant. The total concrete surface area within tanks and conduits that has already been put into use at the new plant is 2,900,000 sf, of which 1,100,000 was originally coated. 412,000 sf of new coatings was installed over existing coatings that have been put in use. A second phase has been added to perform the same tasks from 1998-2000.

CP-144 Pretreatment Facilities/Unit Substation

CP-144 was derived from CP-044 Final Site Completion. The scope of work includes "Chapter 149" Building work (i.e. requires filed sub-bids). Key elements include the North and South Pretreatment Facilities and a new Unit Electrical Substation. These tasks will be performed during the Fall 1998 through Spring 2000.

Secondary Plant Construction

Purpose

The Secondary Plant construction phase includes construction of three secondary reactor batteries, three secondary clarifier batteries, a full treatment pilot plant, a disinfection facility, a seawall, a hydroelectric power station, an effluent outfall tunnel and diffusers, and a potable water storage tank. The total cost of Secondary Plant construction is estimated to be $942.0 million.

- Three secondary reactor batteries, or aeration tanks, will be constructed. Oxygen will be supplied to these tanks from a cryogenic generator. The aeration tanks will contain microorganisms to biologically treat the wastewater. Three secondary clarifier batteries will be constructed to serve as settling tanks for this mixture.

- A pilot plant has been built and is being used as a research tool for testing operations prior to use in the full-scale facilities and to provide a permanent facility for operator training.

- A disinfection facility was constructed to add chlorine to the primary and secondary effluent. A hydroelectric facility powered by the effluent flows from the disinfection facility is also being constructed as part of this phase. The plant has been designed to produce more than 12 million kilowatt hours of electricity per year.

- A deep rock effluent outfall tunnel and diffusers have been constructed to carry treated effluent from Deer Island into Massachusetts Bay. Other secondary treatment plant facilities included in this phase are a secondary odor control facility, the secondary operations building, and the waste sludge system.

The following narrative provides descriptions for only active and future contracts in this phase.

Secondary Reactor and Clarifier Battery C (CP-260)

The secondary treatment facility at Deer Island is a high-purity oxygen activated sludge system. This facility includes selector basins, three secondary reactor batteries (A, B, and C), three secondary clarifier batteries (A, B, and C), a cryogenic oxygen generation system, and a secondary odor control facility. Construction of secondary cross galleries, the secondary operations building, and the waste sludge system are also included in this phase.

Construction of the secondary treatment facilities has been divided into three contracts: Reactor Batteries A and B (CP-202), Clarifier Batteries A and B (CP-203), and Reactor and Clarifier Battery C (CP-260). The Reactor Batteries A and B (CP-202) phase includes the cryogenic compressor building, two of the three cryogenic generation units, a liquid oxygen storage tank, Secondary

Reactor Batteries A and B, the Secondary Odor Control Facility, the Secondary Operations Building, and Reactor Gallery A and B. This phase also includes secondary electrical buildings, portions of the Secondary Cross Galleries, and all the interconnecting piping, electrical, and control systems necessary to make these processes functional. CP-202 was declared substantially complete on June 17, 1997.

The contract for Secondary Clarifier Batteries A and B (CP-203) includes construction of two batteries of secondary clarifiers, secondary gallery A/B, return waste sludge pumping facilities, scum facilities, and electrical buildings. CP-203 was declared substantially complete on November 20, 1997.

The contract for Battery C (CP-260) includes construction of the final cryogenic generation unit, Secondary Reactor and Clarifier Battery C, secondary odor control equipment, duct work for Battery C, and Reactor Gallery C. Also included are secondary electrical buildings, a stair/elevator building, portions of the Secondary Cross Galleries, and all of the interconnecting piping, electrical, and control systems necessary to make these processes operational.

After passing through the primary clarifiers, wastewater from each of the four primary batteries flows through an effluent channel into the secondary reactors. The system utilizes flow meters and control valves to distribute flows among the three secondary batteries under normal operating conditions. The system however, has the capability to regulate flow to each of the batteries. Once the flow is directed to a battery, it normally passes sequentially through the selector and clarifier associated with that battery. The system has the flexibility to transfer or mix flows among secondary clarifier batteries downstream of the secondary reactors.

The selectors provide a controlled environment whereby organisms that settle well and thus are easily removed in the clarifiers predominate over poorer settling organisms. The beneficial organisms are thereby "selected" during this process and harmful organisms are eliminated.

From each selector, wastewater flows through a gate to the respective covered secondary reactor, or aeration basin. These reactors create an environment where oxygen is added for the respiration of the "selected" organisms. The three reactor batteries are located between the primary clarifiers and the secondary clarifiers. Each battery consists of three trains divided into six stages. The first two stages are selectors that serve a dual role as additional aerobic basins.

The remaining four stages serve as oxygen reactor basins. Batteries A, B, and C are separated by two major north-south galleries, Reactor Galleries A and B and Reactor Gallery C.

The primary cross gallery runs east-west and separates the secondary reactor batteries from the primary clarifiers to the south. The secondary cross gallery also runs east to west and separates the secondary reactors from the secondary clarifiers to the north. The galleries provide personnel access and utility routes between adjacent facilities. The cryogenic generation facility is located east of

Primary Clarifier Battery A. The secondary odor control facility is located in the secondary odor control gallery between Secondary Reactor Batteries B and C. The odor control facility utilizes carbon absorption units. The waste sludge system consists of the booster pumps and piping necessary to transport excess secondary sludge from secondary treatment to the residuals area for processing.

A cryogenic generator, or cold box system, supplies oxygen to the aeration basins. The cryogenic air separation process involves compressing and cooling air until liquefaction occurs, removing impurities by low pressure condensation, then separating the oxygen from the air by fractional distillation. The system is composed of three 150-ton per day cryogenic oxygen generators, a control building to house compressors, air filtering equipment, and electrical equipment. Offices, a control room, an analyzer room, locker rooms, a lunch room, and storage and maintenance areas are also located at this facility. A cooling system for each generator and liquid oxygen storage space is also included. The oxygen from the generation area to the reactor basins is transported above ground through a looped 18-inch carbon steel pipe.

The effluent from the reactor basins passes through a shared effluent channel to the secondary clarifiers. In these clarifiers, microorganisms and other suspended matter settle to the bottom. As in the primary clarifiers, chain and flight mechanisms collect settled solids and deposit them in common hoppers. Scum is scraped from the surface of the water and deposited in a scum wet well. Scum from the wet well is pumped to the residuals treatment facilities.

The secondary clarifiers are located north of the oxygen reactor batteries and east of the existing North Main Pump Station. To the east, the clarifiers are bordered by the disinfection basins.

Each battery consists of 18 sets of stacked clarifiers. Each set measures approximately 193 feet long by 40 feet wide by 33 feet deep, with the top open to the atmosphere. The total size of each battery is 1,494 feet long by 193 feet wide.

Two galleries run north/south between basins A and B and adjacent to basin C. These galleries measure 1,494 feet long by 72 feet wide. The galleries house the Return Activated Sludge (RAS) pumps, associated piping and valves, and controls for sludge transfer from the clarifiers to the anaerobic selectors, with waste sludge pumped to the residuals area for further processing.

The scum facilities and pump stations are located on the east side of Battery A, between Batteries B and C, and on the west side of Battery C. These three structures house the secondary scum mixers, scum pumps, and associated piping. The scum is pumped to the residuals area for processing in the digesters. The pump rooms located on the east and west sides of the secondary batteries are 34 feet long by 36 feet wide by 32 feet high with 900 square feet of floor space. Attached is a superstructure with 572 square feet of floor space housing the electrical room, stairs, and scum mixer driver. The facility located between Batteries B and C is approximately 38 feet long by 31 feet wide by 33 feet high with 1,178 square feet of floor space. This structure contains the scum pumps, the scum mixer, an electrical room, and stairs.

The addition of a polymer injection system to the secondary clarifiers was necessary to maintain adequate settleability of sludge. An interim liquid emulsion polymer system was installed within the existing space of the secondary odor control facility to meet the initial needs of Batteries A and B. A new dry polymer system was installed between Batteries B and C and will ultimately serve all three secondary batteries allowing more flexibility in choice of polymers and system efficiency. The system will supply between 4,000 and 20,000 pounds per day of polymer dosage to the secondary clarifier system.

The electrical/stair facilities are located on the roofs of the secondary galleries running between Batteries A and B and adjacent to Battery C. These facilities contain a unit substation, motor control centers to power and operate the clarifiers, return sludge pumps, and associated equipment. Each gallery includes two buildings which occupy 3,520 and 3,014 square feet, respectively.

Disinfection Facilities Phase II/Hydroelectric Plant (CP-241)

The disinfection facilities were to be built in three phases to allow for early construction of the process system, half of the chemical storage, and the disinfection facilities needed to operate primary clarifier Batteries A and B. It was determined, however that the third phase of this contract is no longer needed and therefore it was eliminated from the project scope.

The design criteria for the disinfection basins has been reevaluated in light of the additional detention time that will take place in the new outfall tunnel, resulting in a reduction in the number of disinfection basins from four to two.

The Deer Island Disinfection Facilities are located south of the effluent outfall tunnel shaft and east of Secondary Clarifier Battery A. These contracts include construction of disinfection basins, plant process water pumps, chemical storage facilities, a disinfection gallery, an electrical building, and two low head turbine generators.

As originally planned, the chlorine disinfection basins consist of a serpentine channel making three passes, each 500 feet long, with an overall width of approximately 180 feet for the two basins. The two disinfection basins have been designed to disinfect primary and/or secondary effluent at a peak flow of 1,270 mgd.

The chemical storage facilities consist of six 250,000 gallon tanks and associated equipment for the storage and distribution of sodium hypochlorite and sodium bisulfite. These facilities are located on the south side of the disinfection gallery. Three of the tanks are used for hypochlorite storage, two for bisulfite storage, and one as a standby storage tank for either of the two chemicals.

Provisions for both barge and truck delivery of the two chemicals are included in these contracts. Barge delivery is the primary method of delivery due to the large volume of chemicals required and the mitigation agreement with the Town of Winthrop. Sodium hypochlorite solution is pumped to

the storage facility from barges at the pier through two eight-inch PVC pipes. Similarly, sodium bisulfite solution is pumped to storage through two eight-inch PVC pipes. Sections of the four PVC pipes that are installed underground are laid in concrete pipe chases. MWRA is currently considering the construction of a sodium hypochlorite generation plant on Deer Island. A life cycle cost analysis indicates that on-site generation will be more cost effective than the continuing purchase and transport of the chemical to the Deer Island plant. (see narrative for CIP Project # 1208.)

An 84 feet long by 180 feet wide disinfection gallery, containing process equipment and piping, is located between the disinfection basins and the tank storage area. An electrical building is located on top of the disinfection gallery. This gallery will house the plant water pumps which draw secondary effluent from the disinfection basins. The secondary effluent will be used as non-potable process water throughout the new plant.

A hydroelectric power facility was constructed and will be powered by effluent flows from the disinfection facility. The facility will consist of two turbines with a maximum capacity of 2,000 kilowatts. These turbines will be housed in a deep concrete structure, located in the bypass conduit between the disinfection basins and the outfall shaft. Control systems will automatically adjust the units for changing effluent flows, and shut down the turbines and bypass the flows in the event of a problem with the hydropower equipment.

This hydroelectric power facility will produce an average of 1,400 kilowatts per hour resulting in the production of more than 12 million kilowatt hours per year. Electricity will be fed to the 13.8 kilovolt power distribution system for use on Deer Island.

The portion of the seawall that replaces the existing seawall is also being constructed under this phase. The area covered is from the new Resthaven Cemetery to the south end of the existing seawall, approximately 2,600 feet.

Ancillary Deer Island Modifications Phase III (CP-211)

The Boston Harbor Project design review process identified improvements to the plant design which were not included in the basic contract documents. Some of these items may have been identified too late in the design development stage to be included in the bid documents. Other improvements were not recognized as a need until plant staff actually begin operation of the facility. In both of these cases, the requested changes have been grouped as separate construction contracts, referred to as Ancillary Plant Modifications. There are three phases in total.

These contracts cover a wide array of work. At times it is necessary for portions of an existing scope to be deleted and repackaged into these contracts to avoid potential delay costs. Therefore, some of the components are scope items which have been deleted from other contracts. CP-210 was declared substantially complete on May 28, 1998. CP-211 commenced on October 3, 1997. A September finish date is anticipated.

The remaining items are modifications throughout the plant, including specific civil site and electrical work as well as modifications at the South System Pump Station, Primary Plant, Residuals Facility, and other areas.

Effluent Outfall Tunnel (CP-282)

The outfall tunnel will discharge treated effluent from the Deer Island Plant east/northeast into Massachusetts Bay. This phase includes construction of a vertical access shaft at Deer Island and the effluent outfall conduit, excavation of the outfall tunnel, lining of the tunnel with precast concrete panels, connection of the tunnel to vertical riser shafts, and transport of tunnel spoils to processing sites on Deer Island. The total length of the outfall tunnel, including the portion below the diffusers, is 9.5 miles. The finished diameter of the tunnel will be 24.25 feet.

The outfall shaft is a 30-foot diameter vertical shaft approximately 440 feet deep. The effluent outfall conduit will carry the flow from the disinfection basins to the outfall shaft. With the exception of the upper 110 feet of the Deer Island shaft and effluent outfall conduit, all excavation was completed in rock by driving a tunnel boring machine on a straight grade up from the Deer Island shaft to the diffuser area. The excavation process was completed on September 20, 1996.
Contact grouting and segment repairs continue throughout the tunnel. A December 1998 completion date is expected.

On-Island Residuals Construction

Purpose

This phase includes contracts for construction of facilities required for residuals handling on Deer Island, which consists of sludge thickening and anaerobic digestion. Separate primary and secondary sludge thickening facilities are being constructed in this phase. Primary sludge is thickened in gravity thickeners while secondary sludge will be thickened using solid bowl centrifuges. The total cost of On-Island Residuals construction is estimated to be $318.1 million.

The residuals facilities' operations building will be located in the Operations and Odor Control Center during the interim period when only Residuals 1-A/1-B (CP-301) are on-line. The Operations and Odor Control Center is a 190-feet long by 159 feet wide by 56 feet high, four-level, reinforced concrete building. The final location for the permanent operations center will be the Centrifuge Building.

Permanent Utilities Construction

Purpose

This phase provides the utilities necessary to construct and operate the new Deer Island Treatment Plant, and includes contracts to provide water utility lines through Winthrop (CP-401), yard utilities including permanent distribution lines for electric power and a permanent switchgear facility (CP 427 and 402), a thermal/power plant (CP-428) to provide heat on the island, and combustion turbine generators (CP-431). Process instrumentation and control systems (CP-450), a facility information system, and a plant personnel protection system (CP-452) are also being implemented as part of this phase to provide process and administrative information to supervisory and operational personnel. The total cost of Permanent Utilities Construction is estimated to be $198.6 million.

The following narrative provides descriptions for only active and future contracts in this phase.

On-Site Thermal/Power Plant (CP-428)

An on-site oil-fired power and gas-fired thermal plant was constructed on Deer Island. This contract includes construction of the building that houses the turbine and thermal plant, construction of thermal facilities, and provision of fuel oil storage tanks.

The existing submarine cable to Deer Island serves as the primary source of electric power for the new treatment plant. The power plant is a back-up source of electric power in the event that there is an interruption of the primary supply. According to the Environmental Protection Agency (EPA) mandate, the plant must be able to withstand such an interruption and still provide at least primary level treatment of the full design flow. This requirement was set forth in the Secondary Treatment Facilities Plan.

Two oil-fired combustion turbines and a steam turbine driven by the new boilers, in combination with existing on-island diesel generator capacity, are needed in the power plant to meet the estimated electric load requirements.

The building housing the power plant has been designed with the flexibility to meet future contingencies including a change in purchased power costs which would make it cost-effective for the MWRA to generate its own primary power supply; improved markets for power and/or capacity sales; and a possible need for additional power. The design of the building facilitates plant expansion to become either a primary source of power for the island, or into a larger backup source, as future needs dictate. Such changes to the power plant would require a new air quality permit.

The thermal plant includes two boilers, a steam turbine, and a condensing heat exchanger to provide

high temperature hot water for the central plant heating system for the new treatment plant buildings and for sludge processing. The thermal plant boilers will be fired with digester gas supplemented by fuel oil. Digester gas will be treated to remove hydrogen sulfide before being burned to limit emissions to acceptable levels.

The thermal plant and the power plant are contained within a single building. The fuel oil storage tanks are located to the north of the facility, on the other side of the perimeter road.

Process Information and Control System (CP-450)

The Process Information Control System (PICS) is the plant-wide, computer-based system on Deer Island which controls the treatment process. PICS hardware is distributed throughout every facility and is anchored by a series of area control centers. Communication flows are controlled through a network of conduit, junction boxes, wireways, and duct banks. PICS also subsumes the Facility Information System network which links the Deer Island Treatment Plant computer system to the Charlestown Navy Yard computer network. This system generates plant operations reports and maintains an extensive plant inventory database.

Facility Information System

The Deer Island treatment plant utilizes a Facility Information System (FIS) to provide operations and maintenance management tools for supervisory and operational staff. FIS connects with MWRA's existing management information systems. The additional hardware, software, and programming needed for Deer Island are provided through this contract.

FIS includes an Operations Management System (OMS) with a Plant Operations, NPDES reporting, and Laboratory Information Management System (LIMS) applications. The Plant Operations and NPDES reporting applications provide managers and supervisors with routine operational and compliance reports and process trend information for use in evaluating operational efficiency. LIMS meets laboratory needs for Deer Island process control, NPDES programs, residuals, harbor studies, TRAC, CSOs, off-island residuals, and air monitoring.

FIS also includes a Maintenance Management System (MMS), which provides preventive and corrective maintenance scheduling capabilities and management functions, historical analysis for assessing and improving maintenance and cost, and materials inventory management. MMS will interface with Materials Management, Purchasing, Technical Information Center, CADD/DP, Scheduling, and Safety applications.

FIS also includes administrative applications for safety management, and supporting hardware and data networks. The Facilities Information System contract is managed by the Sewerage Division.

Personnel Protection System (CP-452)

The Personnel Protection System (PPS) contract is comprised mostly of the island-wide fire system, which includes fire detection and suppression capabilities and will automatically alert island staff and the Boston and Winthrop Fire Departments as the situation dictates. PPS also includes a Private Branch Exchange telephone system; a page/party system, (a network of handsets and speakers); a card access system, designed to limit access to specific plant areas; and a closed circuit television monitoring system which provides visual surveillance in key areas.

CP-432 Underground Utilities

CP-432 was derived from CP-044 Final Site Completion. The scope of work consists of the installation of 350 linear feet of 42- inch supply and 400 linear feet of 36-inch return ductile iron pipe with cathodic protection, as well as connections to the portions of the cooling water system installed under previous contracts. CP-432 is expected to be complete in December 1998.

Construction Support Services

Purpose

Construction Support Services contracts provide temporary buildings and utilities, roadway maintenance, rodent control, trash removal, security, and other facilities and services necessary to support the construction effort for the Boston Harbor Project. Providing centralized support facilities and services has helped avoid coordination problems which could occur if contractors were responsible for their own utilities, transportation, and maintenance. The total estimated cost of the 53 construction support services contracts is $87.3 million.

The following narrative provides descriptions only for active contracts in this phase.

Construction Power

Each construction contractor operating on the island requires electricity to operate equipment, and for other purposes. MWRA pays directly for the power consumed during the course of construction, resulting in lower overhead costs.

Construction Water

MWRA pays directly for water required by the construction contractors.

Fuel Supplier III (CP-924)

Approximately one million gallons of fuel per year were consumed on Deer Island during the period of peak construction (1993-1994), and a significant volume of fuel will be required throughout the duration of the project. The first fuel supplier contract (CP-904) provided fuel to BHP contractors on Deer Island from an interim fuel facility (1990-1992). In mid-1992 the Fuel Supplier II contractor commenced a four-year contract (1992-1996) to supply fuel to Boston Harbor Project contractors, the construction support building, the Deer Island treatment plant buildings and vehicles, and to collect and remove used motor oils, hydraulic oils, and oil filters from contractors. Fuel Supplier II provides this service using the newly constructed Deer Island Fuel Facility and its own vehicles for on-island distribution of diesel fuel. Fuel Supplier III (CP-924)is providing this service for the project through November 1998 (1996-1998).

Security V and VI (CP-942 and CP-974)

During the course of construction there will be 25 to 35 field office trailers located throughout Deer Island and Nut Island which contain office supplies and valuable equipment. There are also

equipment maintenance areas and small tool sheds that contain expensive supplies.

To coordinate provision of security services, a centralized security system has been established. This system consists of five stages. The first stage involved a one-year contract (CP-909) to develop the overall security system plan. The second stage (CP-917) expanded the security system plan developed in stage one and provided security for two years ending December 1992. The third stage (CP-930) provided security services for two years ending in December 1994. The fourth phase (CP-935) commenced in 1994 and extended for two years ending in December 1996. The fifth phase (CP-942) commenced in 1996 and will extend for three years until December 1999. The sixth phase (CP-974) will provide this service from December 1999 to December 2000.

The security contracts provide for security personnel stations and mobile patrols for Deer Island, Nut Island, the Suffolk Downs Bus Transportation Parking Facility, and the Squantum Point Water Transportation Parking Facility. Security headquarters is located on Deer Island. The contracts include provision for maintenance of project security records and investigation and reports of security and fire incidents at any of the sites described above.

Site and FRSA Maintenance IV and V (CP-943 and 970)

Temporary construction roadways and sanitary facilities must be maintained for the duration of BHP construction. Five contracts have been required to provide this long-term maintenance. Services for 1990-1992 were provided through CP-910; services for 1992-1994 were provided through CP-931; services for 1994-1996 were provided through CP-936; services for 1996-1998 are being provided through CP-943; and services after 1998 will be provided through CP-970. The services provided under these contracts include the following:

- Snow plowing and removal, and salt and sand spreading at FRSA and Deer Island.
- Maintenance of access roads, drainage systems, and common areas at Deer Island.
- Dust control for access roads and common areas at Deer Island.
- Street sweeper operation at FRSA, Deer Island, and Point Shirley.
- Single-unit portable toilets at Deer Island.
- Sewage holding tank pumping service and janitorial service for site toilet buildings on Deer Island.
- Monitoring of the trash facility and moving of 70-cubic yard trash trailers to and from the RO/RO pier on Deer Island.

- 55-gallon steel drum trash containers at FRSA and Deer Island.
- Common area cleanup services at FRSA and Deer Island.
- Miscellaneous cleanup services at Deer Island.

Trash Handling and Disposal IV (CP-944)

During the course of construction at Deer Island and the FRSA, construction debris and non-hazardous solid waste must be collected and disposed of properly. The trash contractors contain, haul, and dispose of non-hazardous solid waste and construction debris at an approved disposal site. These services were provided through CP-911 for 1990 to 1993, through CP-933 for 1993 to 1995, through CP-938 for 1995 to 1997, and through CP-944 after 1997.

The trash contractors are responsible for maintenance, inspection, and supervision of trash disposal equipment, services, and operations. All Deer Island trash trailers utilize the roll-on roll-off ferry.

Off-Site Maintenance and CSB Housekeeping IV and V (CP-945 and 972)
Off-Site Snow Related Service and Asphalt Sweeping IV and V (CP-946 and 973).

Several off-site facilities that support construction at Deer Island and Nut Island which must be maintained. The facilities at Suffolk Downs, Mystic River, and Squantum Point require janitorial services, general cleanup, site maintenance, and landscaping maintenance. The Construction Support Building on Deer Island also requires janitorial services. In addition, these sites require snow removal and asphalt sweeping. These services have been provided in three stages. The initial janitorial services, general cleanup, and landscape maintenance services were provided by CP-912, while CP-922 provided the road and parking lot snow service and asphalt sweeping. These services were provided through CP-932 and CP-934 through the end of 1994, and through CP-939 and CP-937 for the next three years (1995-1997). After 1997 the services are being provided through CP-945, CP-946, CP-972, and CP-973.

Construction Support Labor Phase V (CP- 954)

The construction support labor contractor provides construction, reconstruction, renovation, reconditioning, installation, repair, and testing of construction support facilities and systems. Work is performed on an as-needed basis under work orders as directed by the Construction Manager (CM). Services may be performed at Deer Island, Nut Island, and all support and transportation sites. This may include work on the existing Deer Island Treatment Plant required due to construction. The first four phases of this contract (CP-950 from 1991-1992, CP-951 from 1992-1993, and CP-952 from 1993-1995, and CP-953 from 1995-1997) are complete. From 1997-2000 services were provided through CP-954.

Construction and Design Services

Construction and Design Services cover those items that cannot be contractually added to existing construction packages. These include items identified during review programs such as Will it Work and System Integrity. The funding for the design of repairs to existing outfall 002 is also included.

Construction Support Labor - Electrical III & IV (CP-968 & 969)
Construction Support Labor - Plumbing II & III (CP-964 & CP-966)
Construction Support Labor - HVAC II (CP-965)

Chapter 149 construction support labor contracts provide building construction, reconstruction, renovation, remodeling, installation, repair, and testing of construction support buildings. Separate concurrent contracts are provided for electrical, plumbing, and HVAC work. Work is performed on an as needed basis under work orders as directed by the CM. Services may be performed at Deer Island, Nut Island, and all support and transportation sites. This may include work on the existing Deer Island Treatment Plant required due to construction. CP-960, 961, 962 and 963 provided services through 1996. Thereafter, through 2000, services are being provided under CP-964, 965, 966, 968, and 969.

Rodent Control III (CP-947)

A three-stage rodent control approach has been adopted for Deer Island. The first stage was a two-year contract (1989-1991) that preceded the Site Preparation I construction contracts. The goal was to eliminate as many rodents as possible before disrupting their natural habitats and to mitigate potential migration of rodents to public areas and abutting properties. The contractor furnished all labor, equipment, material, and supervision to perform a comprehensive and complete rodent control program. The second stage was a four-year maintenance program (1991-1995) to control rodents during the balance of major excavation on the island, including the period of time prior to and during demolition of the House of Correction. A third phase includes control beyond 1995.

Construction Management

Purpose

This phase consists of contracts required to effectively support and manage the construction of the new treatment plant and residual facilities. The provision of consultant services for program and construction management, as well as facilities and job training are included. The phase also includes an insurance program and start-up services. The total cost of Construction Management services is estimated to be $383.2 million.

Construction Management (CM) Services (1990-1998)

MWRA awarded the contract for Construction Management Services to ICF Kaiser Engineers Massachusetts, Inc. (ICF-KE). There was a six-month transition period between the P/CM and CM contracts, from July 13, 1990 to December 31, 1990. MWRA has three three-year options to extend the original CM contract (1990-1995). The extension to the current contract, referred to as Phase II, is for services for the period January 1996 through December 1998. The two CM line items, (1990-1995) and (1996-1998), have been combined into one line item (1990-1998) to reflect the continuing single contract with the CM.

The CM is responsible for all BHP construction management and support activities through the end of the project. The CM team provides services in program support, construction management, and quality assurance/quality control.

Program support includes project management, project controls, information systems, contracts management and administration, project promotion, risk management, and job training.

Construction management includes services directly related to management and support of all BHP construction activities. The CM provides construction and site management, resident engineering and inspection services, contract bid support, logistical management, industrial relations, safety management, substance abuse prevention, and facilities management and support of Deer Island construction facilities. Other services include engineering support and coordination with design engineers during construction and start-up phases of the project, shop drawing administration, record drawings, operational support, and management of a limited number of design activities.

Quality assurance/quality control includes the development and management of an overall program to assure and control quality. The CM also provides design review services in constructability, operability, and value engineering areas. Survey and field coordination, regulatory support, mitigation compliance, and environmental compliance services are also provided by the CM.

Construction Management (CM) (1999-2002)

The option to extend this contract again may be utilized as additional CM and resident engineering and inspection services may be required which are not part of the scope of services currently being provided by the CM.

Facilities Training

Facilities training is the training and assistance required to operate the new treatment plant and laboratory, and to meet all state and federal performance standards. Approximately 500 treatment plant and laboratory employees, and 21 Nut Island treatment plant employees were trained under this phase. These staff learned to operate the new plant equipment and facilities in accordance with standard operating procedures, and to manage and administer the plant safely and efficiently. Training is also being provided for the facility information system and the laboratory.

Project Office

The project offices for the Construction Manager and the Lead Design Engineer are located at the Schrafft's Center in Charlestown, the Fore River Staging Area, Deer Island, Nut Island, Suffolk Downs, and Squantum Point, and provide space for 300 to 350 personnel. The budget for these offices includes estimated cost for telephone services, copying equipment, leases, and utilities.

Professional Services

This line item provides, or has provided for the following services:

- Economic Impact Analysis
- Winthrop Roads Consultant
- Appraisal Services
- Bus Route Consultant
- Suffolk County House of Correction Memorandum of Understanding
- Printing of Bid Specifications
- Office Trailers
- Miscellaneous Professional Services
- Litigation Costs

Risk Management Program

The objectives of the Risk Management Program are to protect the assets and financial well-being of MWRA, to achieve optimum contractor responsibility and accountability, and to minimize the overall cost of the program.

The major components of the program are risk control and insurance. Risk control includes a safety program, which includes the development of a safety manual, mandatory training by contractors of all staff working at the construction site, and creation of an executive committee comprised of MWRA and CM personnel to ensure that the program is comprehensive and effective. Risk control also includes a risk transfer program with commercial insurance and risk sharing provisions, such as contractors contractually sharing in the deductible portions of insured property losses, and a reserves program, which established a fund to protect the MWRA from non-insured losses. Contractually, contractors and consultants are required to provide certain insurance which may include Workers' Compensation, General Liability, Marine Liability, and Automobile Liability Insurance.

Labor Agreement Administration Services

The Boston Harbor Project Labor Agreement (BHPLA) was established to ensure labor harmony and stability among the various skilled trade organizations and contractors throughout construction of the new treatment facilities. The BHPLA supports timely and successful completion of the treatment facilities by providing efficient dispute resolution mechanisms to resolve grievances without work slowdowns or stoppages. On March 8, 1993, the U.S. Supreme Court ruled unanimously in favor of an appeal sought by the MWRA and the AFL-CIO upholding the legality of the agreement. The Court's ruling re-affirmed the original ruling by the Federal District Court and overturned rulings by the First Circuit Court of Appeals. The Supreme Court gave local agencies, including MWRA, the same right private property owners already had to impose uniform labor agreements on all contractors in large projects.

Permit Fees

This line item includes fees for environmental permit acquisition and inspections for the following permit related activities:

- Hazardous Waste Oversight
- Air Quality Plans Approval
- Hazardous Waste Compliance Inspection
- Water Cross Connection Compliance
- Groundwater Discharge Compliance
- Registry of Deeds (Permit Recording Fees)
- Marine Oil Terminal
- National Pollution Discharge Elimination System
- Annual DEP Compliance
- Newspaper Advertisements
- Wetlands Protection Act Application
- DEP Water Quality Certifications
- DEP Chapter 91 Waterways Applications

The Commonwealth of Massachusetts recently enacted a new fee structure for Wetlands Protection Act permit applications. In the past, a standard $25 fee was required for a Notice of Intent for any project. Now, the fee is calculated based on the type of work and its location with reference to specific natural coastal resources, such as a beach or bank. Application fees now range from $50 to $10,000 per project.

Outfall Administration

In order to facilitate the construction of the effluent outfall tunnel and diffusers, a Disputes Review Board (DRB) was established. This board ensures equitable and timely resolution of all disputes between MWRA and the contractors building the effluent outfall tunnel and diffusers. The Outfall Administration contract provides administrative and legal services required for the DRB. This line item also funds the outside counsel for defense of claims against the MWRA.

Outfall Permits

The State Department of Public Safety may require the MWRA to pay for a permit for the effluent outfall tunnel. This item has been budgeted to cover the cost of the potential permit and is still under review.

Outfall Start-Up (CP-288)

The current outfall construction contract will end when the tunnel construction is complete and the tunnel is filled with chlorinated seawater. The outfall must then be "started up", which will include beginning flow through the tunnel, removal of the diffuser caps, and fine tuning of the system for proper operation. The start-up contractor will perform services necessary to accomplish this task.

Building Permits

MWRA must acquire building permits for any buildings or structures under the jurisdiction of the state building code. Most BHP contracts include construction of public buildings which require building permits. The Department of Public Safety's review and permitting process ensures the structural integrity and safety of the buildings and structures. State law requires the payment of a fee to the department.

Miscellaneous Facilities Support

This contract includes repair of city streets and private roads in Quincy and police detail at Revere Sugar and Squantum Point. Additional traffic signals at FRSA, safety and emergency services in Winthrop, and the Belle Isle Marsh Study are also included.

Construction Safety

An Emergency Tunnel Response Team and a safety consultant to review the Boston Harbor Project safety program are provided through this contract.

Fit-Out

Fit-Out is the program which provides non-construction related items necessary for start-up and operation of the new treatment plant. This program includes specific line items including rolling stock, furnishings, shop and maintenance equipment, laboratory equipment, audio-visual supplies, and miscellaneous consumable supplies. Detailed descriptions follow.

Initially, fit-out plans at similar facilities in Washington D.C., Detroit, Baltimore, and Minneapolis/St. Paul were evaluated and adapted to Deer Island facilities based on the Plan of Operations. Industrial engineering and value engineering reviews were conducted on the initial estimates. The overall focus of these reviews was to consolidate purchasing, not only as a cost saving measure, but also to conserve space. The proposed equipment was specified based primarily on function, durability, and life cycle value. All Fit-Out items have been competitively procured.

Fit-Out - Rolling Stock

Rolling Stock includes all mobile plant equipment, such as pick-up trucks and cranes, industrial tricycles for journeymen, and mobile pumps for cleaning and maintenance.

Fit-Out - Furnishings

Furniture quantities were based on the Deer Island staffing plan in which offices, work stations, and maintenance shops were outfitted with desks, chairs, tables, shelving, and other required furniture. Furniture is specified for durability, flexibility, and strength.

Fit-Out - Shop and Maintenance Equipment

This category of Fit-Out is for the purchase of machinery, lathes, drill presses, and other equipment to maintain the new plant. Equipment specifications were based on durability and ease of use, and were designed to accommodate process equipment items specified for Deer Island.

Fit-Out - Laboratory Equipment

This category of Fit-Out is for the purchase of analytical and support equipment to test the various treatment plant processes to demonstrate compliance with the effluent discharge permit. Additional laboratory equipment has been purchased for central wastewater testing needs previously provided by private laboratories at an approximate annual cost of $3 million.

Fit-Out - Audio-Visual/Supplies

This category of Fit-Out is for the purchase of dry marker boards, overhead projectors, and other supplies to support training of plant staff. In addition to overhead and slide projectors, video recorders and monitors will allow for repeats of certain training modules to successive classes and remote training in other plants without training staff support.

Fit-Out - Miscellaneous Fit-Out Supplies

This category of Fit-Out is for the purchase of safety equipment, small tools, and first fills of equipment and supplies such as piping and other raw materials.

Lead Design Services

Purpose

This phase consists of the contracts required to develop, manage, and support the design of the new treatment plant and residual facilities. The total estimated cost of Lead Design Services, including the initial concept design, is $106.3 million.

Lead Design Engineer (LDE) Services

The LDE has primary responsibility for the overall design of the primary and secondary treatment facilities including the tunnels and on-site residuals management facilities. The LDE developed design criteria and standards, provided drawings and outline specifications at the 15-20 percent completion level for all facilities, and provided oversight management of all design work. The LDE also provides engineering services during construction (ESDC), focusing on the integrity of plant-wide systems which contain components designed by a variety of firms. The LDE is managed from an overall program perspective by the CM, with emphasis on schedule, budget, constructability, and operability issues.

The LDE also performs ESDC services for certain facilities. Under the ESDC program, the LDE ensures complete and proper review and coordination of design changes that affect plant-wide systems. This is accomplished through review of selected contractor submittals to address compatibility with plant-wide systems and maintenance. Various engineering models, plans, and documentation are also updated during construction to enable continued engineering coordination of facilities under construction.

The LDE contract also includes detailed design services for those facilities requiring early completion. These services were separate from LDE responsibilities and were performed by different staff. In this capacity, this separate staff functioned as a Project Design Engineer (PDE) and was managed by and reported to the LDE. During construction, this PDE provides traditional engineering services during construction and is managed by the CM.

Computer Aided Design and Drafting/Database (CADD II)

MWRA procured a single standardized Computer Aided Design and Drafting (CADD) system to ensure a cost-effective, functional, and integrated design and construction effort. This CADD system has been used by most of the project design firms and the CM. The system consists of customized CADD software (using discipline-specific design applications and associated project libraries), computer processing units (CPUs), work stations/terminals, and related peripherals. In particular, CADD has facilitated design and construction management in the following areas:

Site Control: Site management and coordination on Deer Island has been critical because of the limited size and congested nature of the site, as well as the need to continue operation of the existing plant during the construction period. The contract limits of the 40 plus construction contractors and the site infrastructure (roads, utilities, buildings, and topography) have been continually updated, monitored, and controlled using the CADD system as a tool. The design contract drawings have all been produced using the project coordinate grid for uniformity and interface control between contracts.

Uniform Drafting Standards: BHP includes 32 design contracts performed by approximately 20 engineering and architectural firms. Uniform drafting standards among all designers have been necessary to ensure consistent drawing development practices.

Standard Identification System: An estimated 30,000-40,000 discrete components have been identified consistently in the drawings to enable contractors, the CM, and MWRA personnel to use a common method to identify and refer to these individual plant components.

Standard Component Data: A database management system is integrated with the CADD system to record and update equipment information for use during the design and construction phases. The system is adaptable for continued use of this information during plant operations.

Water Transportation Facilities (183)

Purpose

The construction of new primary and secondary treatment facilities at Deer Island and the conversion of the Nut Island Treatment Plant to a headworks facility are large, multi-year construction projects at sites which have limited land access. MWRA has developed a transportation system to mitigate the impacts of transporting construction crews, materials, and vehicles, and to provide timely access and egress to the sites. The system transports all materials, equipment, and approximately 50 percent of construction personnel to and from the construction sites on Deer Island to avoid travel through the adjacent communities. The transport system includes ferry and barging services from the Fore River Staging Area (FRSA) in Quincy to Deer Island and barging services directly to and from Nut Island. It also includes bus service to Deer Island for approximately 50 percent of the construction work force.

The water transportation system has required construction of staging facilities, piers, and terminals and the procurement of transport operating services at a total estimated cost of $251.1 million.

For purposes of capital budgeting and project organization, Water Transportation Facilities is comprised of the eight phases listed below, each followed by a description of the scope for current construction and transport contracts.

FRSA Utilities

Each construction contractor using the FRSA for staging has consumed water, gas, and electricity. MWRA pays directly for the utilities consumed during the course of construction, resulting in lower overhead costs. This contract also includes the costs of heating and providing power to the staging buildings constructed under CPs 012 and 017, and power required by the RO/RO operator.

Squantum Point Maintenance
Squantum Point Lease

For construction workers commuting from the south and west of Boston, ferry service is provided from Squantum Point in Quincy. In previously completed contracts, MWRA dredged the channel, and constructed a pier, a gangway, floats, and a secure parking area. MWRA entered into an agreement with the MDC to design this facility in a manner consistent with the MDC's long-term development plan and to provide public access to Squantum Point at all times. Lighting and fencing were installed. General maintenance and housekeeping on the floating pier, gangways, and access ramps is provided, including snow removal, de-icing, cleanup, and minor repairs.

Bus Transportation System (1989-1999) (CP-908)
Bus Transportation System (1999-2000) (CP-927)

The land transport system for construction workers is based at Suffolk Downs in Revere. A private bus transportation operator maintains the buses to transport workers to and from Deer Island.

Water Transportation System - Personnel (1989-1998) (CP-918)
Water Transportation System - Personnel (1998-2000) (CP-926)

The personnel transport system employs a private operator to provide and operate the vessels required for ferry service to Deer Island. The ferry service operates primarily from the Squantum Point and Rowes Wharf sites and covers all three construction shifts, with the majority of trips during the day.

The original contract was for five years, followed by two, two-year renewal options, the first of which has been exercised, extending services into 1998. In addition to the vessels used to transport authorized personnel between the on-shore facilities and Deer Island, the operator supplies an on-call water taxi service for transport of personnel and delivery of small packages. The second phase will provide the service from 1998-2000.

Water Transportation System - RO/RO Transport (1989-1998) (CP-907)
Water Transportation System - RO/RO Transport (1998-2000) (CP-925)

A private operator provides and operates vessels for transport of construction materials, equipment, and vehicles to and from Deer Island. The materials transport operator manages the Fore River Staging Area queue, the roll on/roll off piers, the transport vessels, and the Deer Island receiving area. The transport system operates five days per week for approximately 250 days per year. Materials transport began in June 1990.

The materials transport operator was awarded an initial five-year contract followed by two, two-year renewal options. The operator is required to provide and operate a sufficient number of vessels to transport all scheduled vehicles between FRSA and Deer Island.

Rowes Wharf Permit

MWRA has an agreement with the Rowes Wharf Operations Board that allows MWRA to operate a water shuttle to pick up and drop off passengers at the existing pier. Passengers are authorized personnel including construction workers, site engineers, MWRA staff, and regulatory agency staff.

Residuals Management Facilities (261)

Purpose

Residuals, which are by-products of wastewater treatment processes, must be managed in an environmentally sound manner in order to comply with state and federal regulations. Improved management of residuals is critical to the Boston Harbor Project and is a key element in the federal court schedule.

Project History and Background

MWRA ceased the discharge of sludge and scum into Boston Harbor in December 1991. Interim and long-term treatment alternatives have been developed to manage these residuals of the wastewater treatment process.

An interim sludge processing and disposal phase included the construction and operation of sludge handling facilities at Deer Island, Nut Island, and the Fore River Staging Area (FRSA). The processing facility at the FRSA has four process trains and is equipped with air pollution and odor control equipment. MWRA completed construction of these facilities and began operations in December 1991. As required by federal court order, MWRA was responsible for ending the discharge of sludge into Boston Harbor.

MWRA owns the sludge dewatering and drying facilities at the Fore River Staging Area (FRSA). A private contractor, the New England Fertilizer Company (NEFCO), has been engaged to haul sludge by barge to the FRSA, operate the facility, and market and or dispose of the final product. This approach provides MWRA with ownership of the processing facilities and reserves the option of operating the facilities in the future.

MWRA is modifying and expanding the sludge processing facilities to accommodate the increased sludge volumes expected to be generated by the start-up of secondary treatment at Deer Island. In addition, MWRA will construct two 14-inch sludge pipelines to convey sludge from the Deer Island Treatment Plant to the pelletizer facility at FRSA. One pipe is sized to convey peak sludge volume while the second pipe may act as a back-up for sludge transport or for filtrate return. The sludge pipeline construction budget and schedule are included in the Braintree-Weymouth Relief Facilities project.

In 1993, MWRA sought and received approval for modification of the Residuals Management Facilities Plan. The modification substituted commercial disposal of wastewater residuals for immediate construction and operation of a backup landfill in Walpole. A commercial disposal contract provides transportation and disposal services for wastewater treatment residuals for 30 years. The Residuals Disposal Alternatives Evaluation Committee evaluated the costs of commercial disposal services versus the construction and operation of the Walpole landfill and concluded that the cost of commercial disposal services would be equal to or less than the cost of constructing and operating the Walpole landfill. In addition, the capacity of the commercial facilities is much larger

than that of the Walpole site. This increased capacity provides greater flexibility in the Authority's operation of its residuals program.

Finally, the commercial disposal services allow MWRA to fully comply with the requirements of the Clean Water Act. The cost of commercial disposal services is funded in the Current Expense Budget.

MWRA has developed an emergency preparedness plan which addresses potential interruptions in backup sludge disposal arrangements, and retains ownership of the Walpole site, so that it can construct the landfill without delay if that is deemed necessary.

Scope

Subphase	Scope
Design/CS/RI Pelletizing	Evaluate the capacity of the existing pelletizing plant and use the solids quantity projections derived from the Deer Island pilot plant and other design studies to make a decision on the scope of the expansion. Design of instrumentation and control updates, additional permitting and air emissions requirements, and design of pellet coating, chemical feed, and ventilation/RTO manifold systems
Fast Track Equipment Prepurchase	Prepurchase of two pellet coolers and screens.
Fast Track Equipment Installation	Installation of new safety and process equipment, two new screens, and a pelletizer air recirculation/scrubbing system.
Outside Construction	Work to be completed outside the pelletizing building including Pier 2 rehabilitation, additional rail tracks, an extension to the existing cake loadout garage, additional pellet silos, increased pneumatic transport capacity, and demolition of crane.
Inside Equipment Prepurchase	Prepurchase of 12 centrifuges for dewatering sludge. Maintenance service agreement for centrifuges has been removed from the CIP and will now be funded through CEB. Additional equipment storage insurance costs and acceptance of the equipment upon delivery to the MWRA approved site.
Inside Construction	Work to be completed inside the facility consists of dewatering equipment replacement, modifications to the four existing pelletizing trains, and installation of two new pelletizing trains. Some outside building and utility modifications are also included. Explosion suppression systems, cooling towers, air compressors, pellet coating, chemical feed, and ventilation/RTO manifold systems.
Residuals Research	Study the appropriate application methods, environmental impacts, and agronomic benefits of MWRA's fertilizer in a variety of settings and investigate the cause of pellet self-heating and other microbial activity in the material. Study results aided in developing recommendations for product use, answering questions about environmental suitability, and developing marketing strategies.
License Fee	License fees may be due to a patent holder, Enviro-gro, when NEFCO stops operating the facility.
Royalty Payment	Payment to the holder of the residual process patent

Pelletizing Plant Natural Gas Supply Pipeline (269)

Purpose

To reduce energy costs at the Pelletizing Plant by constructing a natural gas pipeline to bypass the local gas distribution company and connect directly to an interstate pipeline.

Project History and Background

This project is for the design and construction, by means of horizontal directional drilling, of a natural gas pipeline, between the pellet plant at the Fore River Staging Area and the Algonquin interstate pipeline in East Braintree. The pipeline would be drilled through bedrock, starting at the pellet plant and proceeding less than a mile under the Fore River to East Braintree. The pipeline will significantly reduce annual natural gas costs by bypassing the Boston Gas' local distribution system and thus avoiding Boston Gas distribution charges. (The 30-year net present value of total savings range between $2.7 million to $13.3 million. The actual savings will be dictated by the volume of natural gas used at the plant as well as the final cost of construction.)

Scope

Subphase	Scope
Construction	Construct natural gas pipeline.
Design	Design of natural gas pipeline.

Pelletizing Plant Cogeneration Facility (270)

Purpose

To reduce energy costs at the Pelletizing Plant by constructing a cogeneration facility.

Project History and Background

The cogeneration facility will use natural gas to produce heat for use in the dryers and electricity to meet the power needs of the pellet plant. Depending on the ultimate size of the cogeneration facility, there may be opportunities to produce power for other facilities, including other buildings at Fore River and the Braintree-Weymouth Interim Pump Station.

MWRA staff are preparing a life cycle cost analyses for the project based on recently enacted legislation deregulating the energy industry. Initial estimates indicate a 20-year net present value of total savings between $3.0 million and $10.9 million.

Scope

Subphase	Scope
Design	Design of a new cogeneration facility.
Construction	Construction of a new cogeneration facility.

Combined Sewer Overflow Control Program

PROGRAM OVERVIEW

Program Purpose

Portions of the tributary area served by the MWRA sewerage system are served by combined sewers. During heavy rainstorms, sanitary and storm flows exceed the capacity of the collection pipes. The excess untreated, combined sewage is discharged to nearby receiving waters through 81 permitted outfalls. These discharges, known as combined sewer overflows (CSO), contribute a variety of pollutants that can cause violations of water quality standards at local beaches and harm marine and riverine habitats.

The primary objective of the CSO Program is to develop and implement wastewater system improvements that control the volume, frequency, and/or pollutant loading of CSO discharges in compliance with the Federal Clean Water Act and the Commonwealth of Massachusetts Water Quality Standards and in accordance with federal and state CSO policies and guidelines.

Program History and Background

Modern wastewater collection systems consist of separate pipelines to carry sewage and stormwater flows. In older regions of the country, including parts of metropolitan Boston, one pipeline system combines and transports these flows. Combined sewers are designed to carry dry weather flows (sanitary flows) and a portion of the storm flow.

During larger storms, when sanitary and storm flows exceed the capacity of the pipes, the combined sewer system is designed to allow the excess, untreated combined sewage to discharge through relief conduits to nearby receiving waters, including Boston Harbor and its tributary rivers. These discharges, called combined sewer overflows, and the many outfalls at which they are discharged are typically referred to as CSOs.

In the MWRA service area, there are 81 permitted CSO outfalls, located in Boston, Cambridge, Chelsea and Somerville. During heavier rainstorms, these CSOs discharge to Chelsea Creek, Alewife Brook, Dorchester Bay, Boston Harbor and the Charles, Mystic and Neponset Rivers. CSOs in the Boston area are typically activated by rainfall that exceeds 0.1-inch depth, which means that approximately 60 rainfall events per year can cause overflows.

CSO discharges contribute a variety of pollutants to local water bodies, most significantly pathogenic microorganisms and floating debris. Affected beaches, which include L Street, Carson, Malibu, Tenean, Constitution, and Pleasure Bay beaches in Boston, are used by approximately 10,000 people per day during the summer months. CSO discharges also affect shellfish beds. Shellfish harvesting is prohibited or restricted in most of the shellfish beds in the Boston area due to contamination from CSOs and other pollution sources.

Program Structure

The projects within the CSO Program are organized into three distinct categories; MWRA Managed, Community Managed and Planning and Support. Individual project purpose descriptions follow this overview.

MWRA Managed

MWRA has taken responsibility for facilities planning and environmental assessment for all of the CSO projects, as well as design and construction of projects that will be MWRA owned facilities. MWRA-owned and operated facilities will include:

- New sewers and storage conduits that will upgrade the capacities of existing MWRA-owned sewers (Chelsea Branch Sewer and East Boston Branch Sewer) or that will constitute major extensions to existing MWRA and local sewer systems (storage and consolidation conduits).

- Any upgraded or new CSO treatment facility.

- Floatables controls that will serve MWRA-owned CSO outfalls.

MWRA will also manage design and construction of projects that will be Chelsea owned facilities (Chelsea Trunk Sewer relief, CHE008 outfall improvements and floatables control).

The projects within this category include:

- North Dorchester Bay and Reserved Channel Consolidation Conduits and Reserved Channel CSO Facility
- Hydraulic Relief Projects
- East Boston Branch Sewer Relief
- Fort Point Channel and Charlestown Storage Conduits
- Chelsea Trunk Sewer Relief, Chelsea Branch Sewer Relief and CHE008 Outfall Improvements
- Union Park Detention Treatment Facility
- Upgrade Existing CSO Facilities and MWRA Floatables Control

Community Managed

The CSO communities, except Chelsea, are responsible for the permitting, design and construction of projects that will become community-owned facilities. Community-owned and operated facilities will include:

- Improvements to existing local systems, including new sewers and storm drains that will be constructed to separate combined sewers.

- Floatables controls that will serve community-owned CSO outfalls.

The projects within this category include:

- South Dorchester Bay Sewer Separation (Fox Point)
- South Dorchester Bay Sewer Separation (Commercial Point)
- Stony Brook Sewer Separation
- Neponset River Sewer Separation
- Constitution Beach Sewer Separation
- Cambridge Sewer Separation
- BWSC Floatables Control
- Cambridge Floatables Control

MWRA will fund all projects through its CIP, which includes capital costs for planning, design and construction. To establish working relationships to complete the projects, MWRA has developed MOUs and financial assistance agreements with the CSO communities. These agreements establish schedules and funding mechanisms and define ownership and operation responsibilities. The goal of the agreements is to comply with the court schedule, realize water quality benefits in a reasonable time frame, and control economic impact to rate payers.

Planning And Support

This category includes all projects that provide planning and support services at the program level. CSO Planning and Support phases include:

- Planning/EIR
- Master Planning
- Watershed Planning
- Modeling
- System Optimization Plan (SOP) Program
- Technical Assistance
- Technical Review
- Financial Audit
- Land/Easement
- System Assessment

North Dorchester Bay and (339)
Reserved Channel Consolidation Conduits and
Reserved Channel CSO Facility

The North Dorchester Bay Consolidation Conduit is proposed to relocate all CSO and separate stormwater flow away from the South Boston beaches on North Dorchester Bay. CSO flow and separate stormwater discharging through outfalls BOS081-BOS087 will be carried to the proposed CSO facility at Reserved Channel, allowing these outfalls to be permanently closed. North Dorchester Bay is classified SB-Fishable/Swimmable with restricted shell fishing in approved areas. Swimming beaches and shell fishing areas are considered to be critical/sensitive use areas in federal and state CSO policies. The CSO control goal in MWRA's long-term plan is full attainment of beneficial uses by eliminating all CSO discharges to this receiving water, while minimizing upstream flooding and optimizing the diversion of stormwater flows away from the beaches. CSO relocation was selected over sewer separation during conceptual planning, because the options appeared to have similar cost, and sewer separation would introduce additional stormwater and its associated pollutant load to the Bay.

The Reserved Channel Consolidation Conduit is proposed to minimize untreated CSO discharges to the Reserved Channel. In association with the North Dorchester Bay conduit and the Reserved Channel CSO Facility, the Reserved Channel Conduit will provide storage for most CSO flows that would otherwise discharge through outfalls BOS076-BOS080. With the project, untreated discharges will still be possible at these outfalls during rainfall events greater than the five-year storm. The Reserved Channel is classified SB-CSO with restricted shell fishing. This water body is characterized by high commercial/industrial use, as well as some recreational boating. The CSO control goal in MWRA's long-term plan is to attain beneficial uses most of the time by reducing untreated CSOs and otherwise minimizing CSO impacts and upstream flooding.

The Reserved Channel CSO Facility, will provide dewatering of the North Dorchester Bay and Reserved Channel consolidation conduits to the interceptor system after the storm event. Flows in excess of the storage capacity of the conduits will be treated (screening, disinfection and dechlorination) and pumped to Reserved Channel. The preferred site for the new facility is vacant property under the control of the MDC, adjacent to abandoned MBTA power station off East First St. in South Boston.

Hydraulic Relief Projects (354)

The Hydraulic Relief Projects involve localized improvements to increase the capacity of local and MWRA systems to transport and store combined flows, thereby reducing CSO discharges. Specifically, the project includes upgrade of the dry weather connection between the CAM005 regulator and the MWRA interceptor. Also, the weir at CAM005 will be raised to optimize system storage capacity before allowing an overflow event. The project will reduce activations at CAM005 to two per year on average, minimizing CSO impacts to the Upper Charles River at this location. The Upper Charles River is classified B-Fishable/Swimmable and other compatible uses. This section

of the Charles River is characterized by high recreational use and heavy stormwater impacts. The CSO control goal is to attain beneficial uses for most of the year by reducing untreated CSO discharges to minimize CSO impacts.

The Charlestown BOS017 Hydraulic Relief Project is intended to minimize CSO discharges at outfall BOS017 by reducing the volume of flow that passes through the regulator and dry weather connection to the Cambridge Branch Sewer. This will be accomplished by constructing new direct connections to the Cambridge Branch Sewer from local combined sewers that are currently tributary to the BOS017 regulator. The project will reduce activations at outfall BOS017 to two per year on average, thereby minimizing impacts to the Mystic River/Chelsea River Confluence receiving water segment. The Mystic/Chelsea Confluence is classified SB-Fishable/Swimmable with restricted shell fishing. This water body is characterized by industrial (primarily water dependent) uses and is affected by large pollutant loads from the Mystic River, including stormwater loads. Large volumes of commercial water traffic and some recreational boating is evident. The CSO control goal for the Mystic/Chelsea Confluence is to attain beneficial uses for most of the year by reducing untreated CSOs and minimizing CSO impacts. Other projects that affect water quality in the Mystic/Chelsea Confluence are Upgrade to Somerville Marginal CSO Facility, East Boston Branch Sewer Relief, Chelsea Trunk Sewer Relief, Chelsea Branch Sewer Relief and CHE008 Outfall Repairs.

The Charlestown Branch Sewer restriction consists of a short length of conduit at the downstream end of the MWRA Charlestown Branch Sewer ("CBS") that has a severely restricted cross section. Removal of the restriction will lower the hydraulic gradient in the CBS and potentially lower overflows from the CBS to the Prison Point CSO Facility and to the BOS019 outfall, which discharges to the Little Mystic Channel.

East Boston Branch Sewer Relief (347)

This project involves upgrading the entire MWRA East Boston Branch Sewer to increase hydraulic capacity and provide long-term structural integrity. Existing sewers will be replaced or relieved using various open trench and trenchless technologies. Certain existing sewers will be rehabilitated to remain in service. Floatables control will be installed at all CSO outfalls that will remain open. The project will increase transport capacity, thereby reducing CSO discharges at several outfalls along the East Boston shoreline and minimizing CSO impacts to the Mystic/Chelsea Confluence, Upper Inner Harbor and Lower Inner Harbor receiving water segments. See **Charlestown Hydraulic Relief (BOS017)**, above, for CSO control goals in the Mystic/Chelsea Confluence. The Upper Inner Harbor and Lower Inner Harbor segments are classified SB-Swimmable/Fishable with restricted shell fishing. Upper Inner Harbor water quality is affected to a great extent by Charles River and Mystic River flows. The CSO control goals for these segments is to attain beneficial uses for most of the year by reducing untreated CSOs and minimizing CSO impacts.

Fort Point Channel Storage Conduit
Charlestown Storage Conduit (348)

The Fort Point Channel Storage Conduit will provide detention of most CSO discharges at outfalls BOS072 and BOS073. The outfalls will remain open to allow the discharge of overflows that exceed

storage capacity, expected during heavy rainfall events. The storage conduit will reduce CSO discharges at the two outfall locations to approximately two activations per year on average. Construction will take place along a portion of A Street. Fort Point Channel is classified SB-Fishable/Swimmable with restricted shell fishing. This water body is characterized by high commercial/industrial use, but development in the area will increase its aesthetic importance. The Channel is subject to both high stormwater and high CSO flows and pollutant loadings. The CSO control goal is to attain beneficial uses for most of the year by reducing untreated CSOs or providing treatment for more frequent discharges, to minimize CSO impacts. A higher level of treatment (i.e. solids removal) is appropriate given the relatively large contribution of pollutants from CSO.

The Charlestown BOS019 Storage Conduit will provide detention of most CSO discharges at outfall BOS019. The outfall will remain open to allow the discharge of overflows that exceed storage capacity, expected during heavy rainfall events. The 12-foot by 12-foot, 380 feet long conduit will reduce CSO discharges at the outfall to approximately two activations per year on average, to minimize CSO impacts to the Little Mystic Channel and Upper Inner Harbor. Construction will take place between Chelsea Street and the Mystic-Tobin Bridge footings. See **East Boston Branch Sewer Relief**, above, for CSO control goals in the Upper Inner Harbor. This project was originally proposed in the DEIR as a project change from the Conceptual Plan recommendation to construct a screening and disinfection facility.

Chelsea Trunk Sewer Relief (349)
Chelsea Branch Sewer Relief and
CHE008 Outfall Improvements

The Chelsea Trunk Sewer Relief project involves the replacement of a City of Chelsea owned sewer along Medford, Ferry, Winissimet and Marginal Streets to increase hydraulic capacity and provide long-term structural integrity. The new 24-inch diameter sewer will minimize CSO discharges at outfalls CHE002, CHE003 and CHE004 and will alleviate flooding risks in the immediate neighborhood. MWRA will implement design and construction services, but the new sewer will be owned and maintained by the City.

The Chelsea Branch Sewer Replacement project will include partial replacement and relief of the MWRA interceptor, with relining of sections of the existing sewer that will remain in service. New sewers, ranging from 36 inches to 66 inches in diameter, will provide hydraulic relief to both the MWRA Chelsea Branch Sewer and the parallel MWRA Revere Extension Sewer, which was recommended for relief under the "Interceptor Strategies" section of the 1994 System Master Plan. The existing Revere Extension Sewer, Section 61 will also be relined. The project will provide structural integrity to both sewers for the long-term, will reduce CSO discharges at outfall CHE008 and will alleviate sanitary sewer overflows ("SSOs") and flooding risks in the tributary service area.

The CHE008 Outfall Improvements are intended to provided long-term structural integrity to the City-owned outfall. MWRA will manage design and construction services, but the outfall will continue to be owned and maintained by the City of Chelsea. See **Charlestown BOS017 Hydraulic Relief**, above, for information on the CSO control goals for Mystic/Chelsea Confluence.

Union Park Detention Treatment Facility (350)

The existing BWSC Union Park Pumping Station in Boston's South End will be expanded to provide detention treatment to combined CSO and separate stormwater flows that are pumped by the flood control station during heavy rainfall events. Flows are pumped to the Roxbury Canal Conduit, which discharges to Fort Point Channel. The treatment facility will provide screening, disinfection and limited detention to reduce solids. See **Fort Point Channel Storage Conduit**, above, for information on the CSO control goals for Fort Point Channel.

Upgrade Existing CSO Facilities and MWRA Floatables Control (353)

This project involves upgrading five of the existing MWRA CSO treatment facilities (Fox Point, Commercial Point, Cottage Farm, Prison Point, and Somerville Marginal). The Constitution Beach CSO facility will not be upgraded, because it is scheduled to be decommissioned by October 2000, following completion of sewer separation by BWSC. Upgrades will include building related improvements, safety related improvements and treatment related enhancements. Existing chlorination systems will be replaced and improved. Dechlorination systems will be installed at each facility. The Fox Point and Commercial Point facilities eventually will be decommissioned for CSO treatment, by the year 2008, following completion of sewer separation projects by BWSC. These two facilities discharge treated CSO flow to South Dorchester Bay, which has critical/sensitive uses. Cottage Farm discharges to the Lower Charles River; Prison Point discharges to the Upper Inner Harbor; and Somerville Marginal discharges to the Mystic/Chelsea Confluence. The upgraded facilities will minimize CSO impacts to the receiving waters.

Floatables control will be provided at all MWRA CSO outfalls not associated with a treatment facility. The outfalls are located along the Charles River. The selected floatables control technology is underflow baffles, which are proposed to be installed in regulator structures.

COMMUNITY MANAGED PROJECTS

Design and construction of the following projects will be managed by the CSO communities pursuant to a Memoranda of Understanding and Financial Assistance Agreement between MWRA and each community. Capital costs of the projects will be funded by MWRA through a financial assistance program.

South Dorchester Bay Sewer Separation (Fox Point) (340)

South Dorchester Bay is classified SB-Fishable/Swimmable with restricted shell fishing. The CSO control goal is full attainment of beneficial use by eliminating CSO discharges. Relocation of CSO flow away from this receiving water is not feasible. The project involves separation of combined sewers to allow the permanent closing of all CSO regulators tributary to outfalls BOS088 and BOS089. These outfalls are associated with the Fox Point CSO Facility, which is scheduled to be decommissioned by the year 2008, when the separation work is completed.

South Dorchester Bay Sewer Separation (Commercial Point) (341)

South Dorchester Bay is classified SB-Fishable/Swimmable with restricted shell fishing. The CSO control goal is full attainment of beneficial use by eliminating CSO discharges. Relocation of CSO flow away from this receiving water is not feasible. The project involves separation of combined sewers to allow the permanent closing of all CSO regulators tributary to outfall BOS090. This outfall is associated with the Commercial Point CSO Facility, which is scheduled to be decommissioned by the year 2008, when the separation work is completed.

Stony Brook Sewer Separation (344)

The Lower Charles River is classified B-Fishable/Swimmable and other compatible uses and is subject to high recreational uses. The CSO control goal is to attain beneficial uses for most of the year by reducing untreated CSO discharges, treating CSO discharges and/or improving existing treatment, to minimize CSO impacts to the Lower Charles River. (Another project that affects water quality in the Lower Charles River is the Upgrade at Cottage Farm CSO Facility). The separation project will minimize CSO impacts to the Charles River at outfall MWR023 and to the Muddy River, Back Bay Fens at outfall BOS046. The project involves separation of combined sewers to reduce the number of CSO regulators tributary to outfalls MWR023 and BOS046 to five, and reduce CSO discharges to the receiving waters.

Neponset River Sewer Separation (342)

The lower Neponset River is classified SB-Fishable/Swimmable with restricted shell fishing. The CSO control goal is full attainment of beneficial use by eliminating CSO discharges. Relocation of CSO flow away from this receiving water is not feasible. The project involves separation of combined sewers to allow the permanent closing of all CSO regulators tributary to outfalls BOS093 and BOS095.

Constitution Beach Sewer Separation (343)

Constitution Beach is classified SB-Fishable/Swimmable with restricted shell fishing. The CSO control goal is full attainment of beneficial use by eliminating CSO discharges. Relocation of CSO flow away from this receiving water is not feasible. The project involves separation of combined sewers to allow the permanent closing of all CSO regulators tributary to outfall BOS002. This outfall is associated with the Constitution Beach CSO Facility, which is scheduled to be decommissioned by October 2000, when the separation work is completed.

Cambridge Sewer Separation (346)

Alewife Brook is classified B-Fishable/Swimmable. The brook is subject to large stormwater impacts. The CSO control goal is to attain beneficial uses for most of the year by reducing untreated CSOs to minimize CSO impacts. This project involves the separation of combined sewers in areas tributary to outfalls CAM002 and CAM004 to remove stormwater from the combined systems and lower flows to the downstream MWRA Alewife Brook Conduit and MWRA Alewife Brook Sewer. Lowering

flows to these conduits will provide hydraulic relief and reduce CSO discharges to the Brook

BWSC Floatables Control (351)

In accordance with the National CSO Policy requirements for Nine Minimum Controls, the CSO plan recommends that all remaining, active CSO outfalls not associated with other treatment be provided with floatables control. The selected technology is underflow baffles, which are proposed to be installed in existing regulator structures. This project involves the installation of floatables controls at all remaining CSO outfalls owned and maintained by BWSC. Design and construction services will be managed by BWSC.

Cambridge Floatables Control (352)

This project involves the installation of floatables controls at all remaining CSO outfalls owned and maintained by the City of Cambridge. Design and construction services will be managed by Cambridge.

PLANNING AND SUPPORT (324)

Master Planning

This project includes CSO conceptual planning, system master planning and facilities planning/environmental review to develop a long-term CSO control plan.

Watershed Planning

This project provides financial and technical assistance to the Charles River Watershed Association in its watershed planning efforts for the Charles River, known as the IM3 Study. Also included is funding for a portion of the costs of a USGS ater quality study of the Charles River Basin. Results of these studies are expected to provide additional technical information to support the reassessment of the appropriateness of the recommended Charles River controls in the CSO plan.

SOP Program (Includes two projects that are part of the long term plan: Somerville Baffle Manhole Separation and Somerville Floatables Control.)

Schedule Six required MWRA to develop, by June 1993, a plan for optimizing the existing combined sewer systems to maximize transport and in-system storage capacities, thereby minimizing CSO discharges prior to developing and implementing a long-term control plan. In June 1993, MWRA complete a report entitled "System Optimization Plans for CSO Control," which recommended more than one hundred relatively low cost and easily implemented projects to optimize the existing systems. The projects are being designed and constructed primarily by the CSO communities, pursuant to a SOP financial assistance agreement executed between MWRA and each CSO community. Under the agreement, MWRA reimburses the communities for design and construction costs.

System Assessment

The performance of the sewerage system is constantly improving as CSO and non-CSO projects are completed and as maintenance efforts continue to optimize the system's capacity. Updated assessments of the system's hydraulic performance and estimates of CSO discharges based on actual field data are essential to verify the predicted benefits of various implemented CSO-related improvements, to recalibrate the system hydraulic model to reflect updated conditions, and to provide most up-to-date information to support CSO planning and design efforts. This project provides for temporary flow metering and other efforts to gather and evaluate new data.

Financial Audit

Administration of the community financial assistance programs associated with the CSO projects that will be implemented by the CSO communities will be periodically audited by the MWRA Audit Department with the support of outside consultants.

Land/Easement

This project involves acquisition of land and temporary/permanent easements for construction of all MWRA-implemented projects. This project also includes acquisition support services, such as-needed surveys, title searches and appraisals. Related costs for construction of community-implemented projects, for which land and easement requirements are expected to be minimal, are included in the budget for each project.

ADDITIONAL PROGRAM HISTORY AND BACKGROUND

MWRA Planning Efforts

In 1987, MWRA accepted responsibility for CSO control planning within the combined systems hydraulically connected to MWRA's system, including the systems owned and operated by the communities of Boston, Cambridge, Chelsea and Somerville (the "CSO communities"). Since then, MWRA has conducted regional planning efforts to develop a long-term control plan that would bring the Boston area CSOs into compliance with the Clean Water Act. MWRA has conducted its planning in conformance with federal and state CSO policies and associated guidance documents, which have evolved during the planning duration. Most of work has been the subject of schedule milestones in the federal court order in the Boston Harbor Case.

The first set of CSO milestones in the court schedule included a requirement to conduct facilities planning and environmental review of CSO control alternatives. The Authority conducted this work in the period 1988-90 and completed a Facilities Plan and EIR in September 1990. The recommended control plan included construction of a deep tunnel storage system for most of the affected receiving waters, with near surface storage proposed for Alewife Brook and limited sewer separation proposed in a few, small areas. The estimated capital cost of the plan, in 1990 dollars, was

approximately $1.2 billion.

In 1991, MWRA developed a new planning phase that was intended to build on the 1990 study and address several critical issues, including the need for more extensive flow monitoring, primarily to examine the impact of ongoing system upgrades (e.g. fast track pumping improvements at Deer Island) on CSO frequency and volume, and the need to evaluate CSO control in the context of a broader wastewater system master plan. To respond to these needs, MWRA initiated CSO/System Master Plan activities in 1992. The Master Plan involved the following planning objectives:

- Improve the Authority's understanding of the combined sewer and regional wastewater systems through system inspections, flow monitoring, water quality monitoring, and performance assessments.

- Optimize the performance of the existing systems through relatively low cost, easily implemented structural and/or operational modifications.

- Reassess CSO control needs in the context of evolving EPA policy.

- Reassess CSO control needs in the context of a system master plan.

In 1994, MWRA completed a Baseline Water Quality Assessment document which examined the existing water quality in 14 receiving water segments affected by CSOs. These segments were characterized and distinguished based on geographical location, frequency, and volume of existing CSO discharges, and existing uses (i.e. fishing, swimming, shell fishing, boating, etc.). All of these activities and resources are also affected to some degree by pollution from separate stormwater discharges and other point and non-point sources. While CSO control will improve water quality, other sources of pollution may still cause violations of water quality standards. The Baseline Water Quality Assessment Report provides information on the loadings of various pollutants to these receiving waters from CSOs, separate stormwater, and upstream river sources.

Final CSO Conceptual Plan and System Master Plan

In December 1994, the MWRA submitted copies of its Final CSO Conceptual Plan and System Master Plan to the court parties in compliance with Schedule Six of the Boston Harbor Case. The report presented MWRA's revised recommended plan for CSO control which included 28 projects at an estimated capital cost of $370 million (1995 dollars). It also examined how, since 1987, many of the Authority's completed and ongoing projects to improve the wastewater collection, transport and treatment systems have markedly reduced CSO discharges.

These recommendations, together with system optimization plans and major improvements already planned, designed or constructed in the collection and treatment systems, form MWRA's overall plan for long-term CSO control for Boston Harbor and its tributaries.

The recommended CSO control plan focuses on the control of bacteria and floatables to increase swimming, shellfishing, and aesthetic/recreational uses of water bodies. Improvement of these uses

through the control of bacteria and floatables is measured by reduction in the annual frequency of untreated combined sewer overflow events, as well as the reduction in the loading of these parameters. The recommended control levels are summarized as follows:

- Elimination of CSOs discharging to critical use (swimming and shellfishing) waters of Dorchester Bay, the Neponset River Estuary, and Constitution Beach.

- Reduction of CSO discharges to minimize impacts in other receiving waters average of four or less untreated overflows per year.

- Construction of two new CSO treatment facilities and upgrade of five of the six existing CSO treatment facilities (Cottage Farm, Prison Point, Somerville Marginal, Fox Point and Commercial Point) to treat CSO discharges that are predicted to activate more than four times per year on average. The sixth existing facility, Constitution Beach, will be decommissioned when the recommended sewer separation project for that area is completed. Fox Point and Commercial Point may also be decommissioned following longer term sewer separation projects.

The table at the end of this program narrative provides a complete listing of the recommended CSO projects and associated capital costs.
The revised plan is substantially different from MWRA's 1990 tunnel plan. Lower CSO flows, improved performance of MWRA's transport and treatment systems, and MWRA's receiving-water approach to CSO planning were the key factors in the development of a more cost-effective CSO control program.

The recommended CSO control plan was developed as a component of an overall System Master Plan, which also addressed I/I reduction, interceptor relief, and secondary treatment. As a result of this work, the report presents several conclusions:

- MWRA concluded that an overall moderate level of I/I control, at an estimated cost of $137 million, can be achieved from community infrastructure improvement and maintenance programs, the MWRA Financial Assistance Program, and its new flow-based wholesale sewer rate methodology. The overall result will be to improve the condition of the community and MWRA infrastructure and to preclude any additional increase in I/I flows within the system. The I/I conclusions and recommendations will be further addressed under MWRA's I/I Financial Assistance Program and other MWRA community I/I programs.

- MWRA identified hydraulic problems in its interceptor system and included recommendations to resolve these deficiencies. The Sewerage Division will incorporate these recommendations, estimated to cost up to $30 million, into its Comprehensive Long-Range Plan. System Master Plan (SMP) Interceptors project is based on these recommendations. Other proposed interceptor improvements, which primarily target structural problems, will also be incorporated into the comprehensive plan. The plan will establish priorities for implementation of the interceptor projects.

- Based upon the preliminary evaluations of secondary treatment capacity completed under the

System Master Plan, the Authority determined that between two and two-thirds and three batteries (720 to 810 million gallons) of secondary treatment capacity were required at Deer Island, as opposed to the four batteries proposed in the 1988 Secondary Treatment Facilities Plan. These preliminary results were evaluated in more detail in a report issued under the Authority's DP-29 contract (Deer Island Concept Design Reassessment). In 1995, the federal court eliminated the need to build a fourth secondary treatment battery from the BHP.

CSO Facilities Plan and Environmental Impact Report

In October 1996, MWRA completed a new Draft CSO Facilities Plan and Environmental Impact Report ("DEIR"), which evaluated and documented the recommended plan presented in the CSO Conceptual Plan pursuant to state and federal CSO policies, DEP facilities planning requirements and MEPA environmental review regulations. While the Conceptual Plan formed the basis for the DEIR, additional, more detailed engineering analyses and siting and impact evaluations led to several project changes. Two projects--Cottage Farm Outfall Improvements and Dorchester Brook In-system Storage--were deleted from the recommended plan in the DEIR, because it was determined and shown that these projects would not provide additional cost-effective benefit. Several other projects were modified. Proposed screening and disinfection facilities proposed in the CSO Conceptual Plan at CAM005, BOS017 and BOS019 were deleted and replaced with hydraulic relief and storage projects. Screening and disinfection at the proposed Reserved Channel CSO Facility was also deleted in the DEIR recommended plan because it also was determined not to provide cost-effective additional benefit, due primarily to the infrequency of predicted discharges to Reserved Channel. Finally, the DEIR recommended that the North Dorchester Bay Consolidation Conduit, which was proposed to relocate CSO discharges away from the South Boston beaches, also collect and transport separate stormwater that also discharged to the beaches.

The DEIR presented preferred sites and alignments for each of the projects, based on a comprehensive evaluation of the project area and site alternatives. The estimated costs of acquiring the sites and handling contaminated materials was incorporated into the overall capital cost of the plan. These costs were not included in the estimates presented in the Conceptual Plan, as sites had not been selected. The estimated capital cost for all 26 CSO projects recommended in the DEIR was $423 million (1997 dollars). Annual O&M cost for the proposed facilities was estimated to be $2.2 million.

The DEIR was subject to public review during a 60-day comment period. Approximately 40 comment letters were submitted to MEPA, from which 540 specific comments were identified. These comments formed the basis for preparing the Final CSO Facilities Plan and Environmental Impact Report ("FEIR"). The FY99-01 CIP was prepared in final form during the preparation of the Preliminary Design Report (PDR) but prior to its completion. Therefore, the FY99-01 CIP reflects the recommendations and costs presented in the FEIR, but modified with additional information collected for the PDR during the winter and spring of 1998. The total capital budget for the plan as indicated in the FY99-01 CIP is $491 million.

The final FP/EIR was submitted to MEPA on August 8, 1997 and was subject to a 60-day public comment period. The Secretary's Certificate on the FEIR and DEP action on the facilities plan were issued in October, 1997. Overall, the recommended CSO plan in the 1997 FEIR is similar to the plans in the 1996 DEIR and the 1994 CSO Conceptual Plan. The FEIR carries forward and continues to recommend the project deletions and changes proposed in the DEIR, with one exception: while screening at the proposed Reserved Channel CSO Facility continued not to be recommended, the FEIR reintroduces the recommendation for disinfection of the North Dorchester Bay and Reserved Channel CSO flows. Disinfection would be accomplished by chlorinating the flows near the proposed CSO facility, and dechlorination would also occur, prior to discharge to Reserved Channel.

In December 1997, in compliance with a milestone in Schedule Six, DEP issued its water quality standards determinations for CSO-impacted waters. The determinations were accompanied by a Use Attainability Analysis (UAA), which was prepared by DEP to support the determinations and satisfy EPA regulatory requirements. DEP determined that most of the receiving waters subject to remaining CSO discharges under MWRA's plan would be classified B (CSO), which allows minimum CSO impacts to remain. By this determination, DEP essentially approved the MWRA's CSO plans for those receiving waters. The determinations were approved by EPA in February 1998.

For the Charles River, Mystic River and Alewife Brook, DEP will issue variances, which will allow continued CSO impacts on a temporary basis, until more information is developed to ascertain the long-term water quality goals for these receiving waters. Variances and accompanying variance conditions are expected to be issued to MWRA in 1998. The variance periods will likely last no more than two years, during which time MWRA must comply with several conditions that will primarily involve additional data collection and analyses to support a reassessment of CSO control needs. In the meantime, MWRA will be required to implement its recommended plan for CSO control in each of these receiving waters.

The following project changes recommended in the FEIR are included in the FY99-01 CIP.

1. Stony Brook Sewer Separation

   The FEIR recommended sewer separation in lieu of treatment to control CSO discharges to the Stony brook conduit. Most overflow locations will be permanently closed while the discharge frequency of the remaining overflows will be reduced from 30 per year to approximately one per year. Also, this project will shift from an MWRA managed project to a Community managed project under the direction of BWSC.

2. Hydraulic Relief Projects

   The revised recommendations will reduce capital cost from $1.8 million to $192,000 as it would require much less construction in the Mt. Auburn Hospital area. Although slightly more annual CSO discharge volume would remain than under the DEIR recommendation, water quality improvement in the Charles River would not be affected.

3. Charlestown BOS019 Storage Conduit

   The FEIR proposed extending the recommended storage conduit an additional 15 feet in length, in order to reduce CSO activations from the DEIR's proposed four per year to two per year.

4. North Dorchester Bay and Reserved Channel Consolidation Conduits Reserved Channel CSO Facility

   The DEIR indicated approximately 15 million gallons of flow would be discharged without treatment during an average rainfall year. The FEIR recommends providing floatables control by installing underflow baffles in upstream CSO regulators and disinfection to provide water quality improvement and help control odors at the proposed facility and in the proposed South Boston conduits.

5. CSO Facility Upgrades

   Proposed upgrades to existing MWRA CSO treatment facilities, which are under design but also discussed in the FEIR as part of the overall CSO control plan, will soon be the subject of a Notice of Project Change to MEPA. The addition of dechlorination to the existing facilities at Fox Point, Commercial Point, Somerville Marginal and Prison Point has proven to be technologically difficult and may require the siting of downstream facilities to house dechlorination systems.

Implementation of the CSO plan as reflected in the FEIR is subject to regulatory and court party acceptance of the project changes and on resolution of the reassessment by the Authority and the parties relative to the appropriateness of the recommended Charles River controls.

CSO Implementation Plan and Schedule

Implementation Plan

The CSO Conceptual Plan proposed that some of the recommended CSO projects be implemented by the Authority and others implemented by the CSO communities. The CSO Conceptual Plan assumed that all capital costs for the planning, design and construction of the CSO projects, including the projects that will be implemented by the communities, would be funded under the Authority's CIP. Memoranda of Understanding (MOUs) and financial assistance agreements between the Authority and the CSO communities have been executed to formalize this plan. The Authority's responsibilities will include facilities planning and MEPA review of all projects, as well as design and construction of those projects that will result in MWRA-owned facilities. The communities implementation responsibilities will include permitting, design, and construction of those projects that will result in community-owned facilities. Under the plan, approximately $154 million of the total $491 million in projects will be implemented by the local communities. Changes to the MOU's and financial assistance agreements will be made to reflect FEIR project charges and cost estimate changes.

The implementation responsibilities discussed above reflect directly the longer term ownership, operation and maintenance requirements of the facilities, with the exception of certain projects in Chelsea, which will be implemented, but not owned, by the MWRA.

Schedule

The CSO Conceptual Plan included a "Proposed Implementation Schedule," which presented time frames for planning, design, and construction of the CSO projects recommended in the report. Adjustments to the schedule have been made through discussions with the communities, EPA and other parties relative to the development of MOUs and agreement on court schedule milestones. The schedule was finalized in June 1996, when the court adopted new CSO milestones for planning, design and construction. The court schedule includes design start dates and construction start and end dates for each of the recommended CSO projects. It also includes milestones for MWRA planning activities, regulatory agency review and DEP water quality standards determinations.

Schedule Six was revised in April 1997 and in July 1998, to reflect certain project changes recommended in the DEIR and FEIR respectively.

Water Quality Standards Determinations

The MWRA's CSO Plan is subject to review and approval for compliance with the state Water Quality Standards (WQS). In December 1997, DEP issued B_{cso} determinations for all CSO impacted waters except the Charles River, Mystic River, and Alewife Brook. The determinations essentially approve MWRA's long-term CSO plan for the pertinent areas. DEP is expected to finalize variances for the Charles, Mystic, and Alewife by the end of 1998, allowing MWRA's plan for these waters to move forward, while stipulating additional work to further investigate the benefits of higher control levels.

Coordination with Other Major Projects

Several of the CSO projects may be affected by major projects proposed by others (e.g. I-93 Reconstruction in Somerville; Central Artery). Coordination efforts are essential.

Watershed Planning

The Authority plays an active role in support of watershed planning activities, working closely with EOEA's Watershed Initiative Steering Committee, Technical Advisory Group subcommittee and Process Group subcommittee and with the technical committee overseeing the ongoing Charles River Watershed Association's (CRWA) watershed planning efforts. The Authority is also partially funding the Charles River Watershed Association's study, as approved on October 5, 1994 and May 1, 1996. In addition, MWRA is partially funding an intensive water quality study of the Charles River Basin by USGS. This funding was required by the CSO variance for the Charles River.

The results of the state and CRWA planning efforts may affect the level of CSO control that is determined to be necessary and cost-effective in meeting water quality standards. The CSO Plan was

developed in the context of overall pollution impacts from CSO and non-CSO sources. Watershed planning is necessary to develop a comprehensive plan for water quality improvement in the various receiving waters.

Infiltration/Inflow Local Financial Assistance Program (128)

Purpose

Infiltration/inflow (I/I), groundwater and stormwater which enters the collection system, contributes more than half of the total wastewater flow that the Authority treats. This depletes capacity that would otherwise be available to transmit sanitary flows. This situation results in sewer surcharging, overflows of untreated sewage, more frequent combined sewage overflows, and higher pumping and treatment costs. The I/I Program provides funding incentives for communities to rehabilitate their collection systems with the goal of structurally reducing I/I flows.

Project History and Background

MWRA's wastewater treatment plants receive flow from 43 communities. The collection system encompasses 230 miles of MWRA interceptors and 5,400 miles of community sewers. These sewers are of varying size, shape, age, material, depth, and condition, but all contribute some quantity of infiltration and inflow (I/I).

On August 19, 1992, the MWRA Board of Directors approved $25 million to fund the I/I Local Financial Assistance Program. On June 28, 1995 the Board approved $38.75 million to fund the second phase of the Program. The $2 million which remained unused from the initial program was rolled over into phase 2 resulting in funds to be allocated under phase 2 totaling $40.7 million. In addition on May 6, 1998 the Board approved $37.0 million to fund the third phase of the program. Since the allocation of funds in Phase III significantly differs from Phase II, it was decided that a community would need to exhaust their available Phase II funds prior to becoming eligible for any Phase III allocations. The program provides funding incentives for communities to rehabilitate their collection systems with the goal of structurally reducing I/I flows. The Program funds are allocated to the 43 sewer service area communities based on their share of MWRA's wholesale sewer assessment. Each award consists of a 25 percent grant and a 75 percent interest free loan for Phase I and II, and a 45 percent and 55 percent loan allocation for Phase III. Binding commitments for funds are issued by the Authority in the form of Financial Assistance Agreements. The program budget is authorized through FY05

Projects completed under the I/I Local Financial Assistance Program have helped meet the Massachusetts Department of Environmental Protection (DEP) grant condition for the Wellesley Extension Sewer Replacement project that requires the MWRA to reduce inflow in the southern collection system by 53 million gallons per day. The inflow removal was documented in a letter to DEP, dated December 11, 1995. Other DEP conditions for interceptor projects have also been met. The Authority will continue to aggressively pursue I/I reduction through cooperative efforts with all 43 MWRA sewer communities.

Through June, 1998, the MWRA has distributed a total of $42.6 million in funds to 41 of the 43 communities under the I/I Local Financial Assistance Program.

Scope

Subphase	Scope
Grant & Loan	Amount allocated to a community in proportion to community's share of rate revenue. Phase II Grant portion is 25 percent and loan portion is 75 percent of total award. Phase III grant portion is 45 percent and loan portion is 55 percent of total award.
Repayment	Loans are repayable to the Authority in ten equal semi-annual payments beginning one year after the funds are distributed.

Sewerage System Mapping Upgrade (138)

Purpose

The project will enhance the accuracy of existing and newly created GIS maps of sewerage communities to improve the quality of hydraulic analysis and reduce staff time and effort necessary to respond to emergencies within the transport system.

Project History and Background

The objective of this project is to capitalize on past investments by both the Sewerage and Waterworks Divisions in order to improve the accuracy of the maps of the Sewerage Division's Interceptors and Facilities. To minimize costs, the Sewerage Division proposes to migrate its data to new base maps for those towns where new data is available from the Waterworks Division at no cost to the Sewerage Division (31 towns), develop new base map data for those towns where new data is not available but the MWRA has significant lengths of the interceptors (6 towns), and make existing data visually consistent with the new adjacent base maps for the remaining communities (7 towns)

The Sewerage Division has invested significant amounts of money and staff time to develop the SAMS GIS data used to produce various kinds of maps for the Sewerage Division, other divisions, and communities within the MWRA service area. Recently, the Waterworks Division decided to develop their own distribution facilities data and maps. As part of the project, Camp Dresser & McKee (CDM) performed a life cycle cost analysis (LCCA) -- looking at needs, and at existing base map data within MWRA and from other sources. One critical finding was that the operations staff could not always use existing maps to reliably locate facilities, and that the resulting of cumulative annual cost of staff time was very costly. Based on the analysis, the Waterworks Division purchased a license from Boston Edison (BECo) for a set of high accuracy up-to-date base map data. The Waterworks Division is working with CDM to overlay the MWRA Water Distribution System and Facilities on these base maps to produce accurate high quality maps.

The BECo base map data is not only more accurate than the SAMS data but also provides good feature labeling and elements not now available to Sewerage Division users. For example, the BECo data includes the building outlines and the property boundary lines for some of the communities (See Figure 1). The availability and use of more accurate maps and additional geographic features will result in CEB and CIP savings and other benefits to staff throughout the Division.

The Sewerage Division maintains geographic data on forty-four municipalities: the forty-three municipalities in the service area and Dover which is traversed by MWRA interceptors. The level of data improvement proposed depends on the data available and MWRA facilities in the communities.

The project must be implemented in the proposed time frame in order for the MWRA to gain the maximum benefits from the Waterworks Division's $400,000 investment in improved base map data. These benefits include operational, computer hardware, and data maintenance savings. Use of the more accurate data will save time and effort of the Sewerage Division's operations staff. This is especially

critical when Transport and TRAC staff are responding to an emergency. Engineering Staff will also be able to save on capital projects by providing consultants with more accurate data. The more accurate data will also improve the quality of the Division's hydraulic analysis and other planning functions.

MIS, Waterworks GIS and Sewerage GIS maintenance costs will be reduced because the Waterworks and Sewerage Divisions are using the same base map data and two sets of base map data will no longer need to be maintained and stored. Because the new Waterworks Division's base map data will become the MWRA standard, and will be used authority wide, the Sewerage Division GIS needs either to migrate the SAMS data to the new standard or to stay alone making it impossible to produce detailed maps which include both water and sewer pipes.

There are a few communities (currently Brookline, Milton and Newton) which have acquired the BECo data and are using it to develop their own GIS systems. These communities, any others which will acquire the BECo data in the future, and the MWRA will benefit from the data sharing possibilities of using a common base map. There are other communities such as Melrose and Cambridge which are within the MWRA service area but not common with BECo. These communities have already developed base map data similar to the BECo data with their own GIS system. As communities discover the capabilities and benefits of GIS, the demand for GIS assistance for various kinds of projects will increase. There will, for example, be more communities using GIS for their engineering and planning departments. The BECo land base data is the highest accuracy, most up-to-date regional base map data available in the current market and it is recognized as such by many communities, public agents and private consultant firms.

The estimated costs are maximum costs. The Sewerage Division will investigate whether any of the communities in which MWRA has significant lengths of pipe and has no new base map data are in the process of developing a GIS system. If any of these communities are willing to enter into a data sharing agreement with MWRA, or would be interested in jointly developing and benefiting from a new accurate base map, the final cost to MWRA for this project could possibly be reduced. The Waterworks Division's research indicates that Wellesley, Quincy, Hingham and Wakefield have done a GIS needs assessment.

Scope

Subphase	Scope
Base Maps	Create new base maps for six towns.
Migrate Existing Data	Migrate existing SAMS data to new accuracy base map for 31 towns.

Walnut Hill Water Treatment Plant (542)

Purpose

To provide high quality drinking water to MWRA customers and to ensure that the water delivered from the Wachusett Reservoir meets the drinking water quality standards established by the federal Safe Drinking Water Act (SDWA). Part of this objective will be met by constructing a 405 million gallon per day (maximum) water treatment plant.

Project History and Background

Pilot and Demonstration Treatment Studies

An initial Pilot Treatment Program study was completed in 1993 to evaluate alternative filtration, disinfection, and corrosion control processes and determine which were most appropriate for MWRA source waters. A small scale demonstration water treatment plant was constructed to test and confirm the recommended and DEP-approved treatment processes based on pilot plant results, to acquire more information on backwash and solids disposal issues, and to produce design data for a scale plant. The demonstration plant began operations in 1994 and completed operations in September 1995. The results proved that it is possible to produce comparable water quality at a higher treatment rate than the DEP approved rate. The higher treatment rate will reduce the overall capital cost of the water treatment plant. A request to revise the DEP approved rate has been approved. The demonstration plant results were incorporated into an updated study that identified potential locations for constructing treatment facilities. This study will be further revised when additional information on federal and state standards becomes available, and will include a more detailed assessment of the forthcoming Disinfection By-Products Rule.

Environmental Review and Conceptual Design

The EIR and Conceptual Design for the treatment plant included environmental reviews, data collection and analyses, and facility designs which support the dual track compliance approach. To support the less expensive non-filtration track, more information was developed on how the Wachusett Reservoir and watershed function as a system, the causes of the reservoir's historic inability to meet the filtration avoidance criteria, and what actions could be taken to rapidly improve water quality. For both the filtration and non-filtration alternatives, detailed siting and environmental studies were conducted and conceptual designs prepared. The Conceptual Design Reports include life cycle cost analyses, process design criteria, site plans, plant hydraulics, and additional design specifications.

Treatment Plant Design

The Walnut Hill Water Treatment Plant (WTP) design incorporates three alternatives: 1) Chlorine/Chloramination, 2) Ozone/Chloramination, and 3) DAF/Ozone/Filtration/Chloramination. All three alternatives include raw water pumping, a 50-million gallon clear well for finished water storage, corrosion control facilities, and raw and finished water connections and are being designed in a modular fashion so that construction can proceed from one alternative to another if necessary. Design will provide additional information to understand the key issues and to estimate the incremental benefits of the proposed chlorination, ozonation, and filtration treatment alternatives, and system rehabilitation alternatives to the communities and individuals served by MWRA. Additional studies to be conducted include investigations on public health, regulatory and institutional frameworks, comparisons of water quality with both filtered and unfiltered water systems, evaluations of other unfiltered systems strategies, the development and evaluation of a set of coherent water quality improvement options including treatment, and other MWRA and community distribution system and management changes.

Design Management Support

The Walnut Hill WTP is a major and complicated project proceeding under a DEP Consent Order schedule. Management support services during the design and construction phases are needed to assist MWRA staff. Professional services for design review and value engineering will have been procured from engineering firms having resources and expertise for these tasks.

Construction Management and Resident Inspection

The construction phase of the Walnut Hill WTP will be managed based on a model similar to that used on the Boston Harbor Project and the MetroWest Water Supply Tunnel. Under this approach, MWRA has hired a construction management firm (CM), to provide a full range of construction management services. The CM will be responsible for day-to-day construction management services, including resident engineering inspection, quality assurance, environmental and mitigation compliance, cost and schedule management, safety, document control, contract management, change order control, labor management, training, testing, start-up, and warranty issues. The CM will coordinate the resolution of technical construction issues with the Design Engineer who will provide technical support. The Waterworks Capital Engineering and Construction Department will oversee the construction program and provide direction to both the CM and the design engineer. The design engineer will provide engineering services during construction.

Open Reservoir Water Quality Study

In June 1993, MWRA entered into a consent order with Massachusetts DEP to provide covered distribution storage reservoirs and to remove existing open reservoirs from service except use for emergency storage at Norumbega, Weston, Spot Pond, and Fells reservoirs. Water quality in these

open reservoirs needs to be maintained to avoid unreasonable degradation. This study will evaluate ways to maintain the water quality in these open reservoirs.

AWWARF Red Water Control Strategy Study

Many communities served by MWRA have experienced discolored water in their distribution systems, some with severe problems. The discolored water, which is typically characterized as yellow, red, or turbid, is caused by the release of iron from older, unlined cast-iron pipe. This study will evaluate treatment options for eliminating discolored water, and will investigate the fundamental aspects of iron chemistry and corrosion using unlined cast-iron pipe from MWRA's community distribution system.

The total study cost is estimated to be $400,000 (without American Water Works Research Foundation (AWWARF) funds). By consolidating efforts with AWWARF, the cost has been reduced to $200,000. The project began in early 1997 and will be completed in early 2000.

Cryptosporidium Inactivation Study

The adverse public health impacts of *Cryptosporidium* have focused public and regulatory attention on the control of this pathogenic organism by public water suppliers. In order to address public concerns and to comply with future regulations, public water suppliers must design and operate disinfection systems that ensure *Cryptosporidium* inactivation. There are no applied inactivation levels for *Cryptosporidium* in natural source waters using demonstrated disinfection strategies. The objective of this study is to develop design criteria for full-scale disinfection systems based on *Cryptosporidium* inactivation levels determined from bench-scale disinfection experiments. MWRA could potentially achieve substantial savings in construction and O&M costs of the proposed Walnut Hill Water Treatment Plant disinfection facilities through the application of the design criteria developed in this study. AWWARF is providing partial funding for preparation of the final study report.

Interim Disinfection Facility

The design of an interim disinfection facility at Shaft A is currently underway. Construction of the facility will allow MWRA to meet current primary disinfection requirements of the Safe Drinking Water Act considerably sooner than the dates included in the Wachusett Consent Order for the permanent water treatment plant. At the interim disinfection facility, free chlorine (sodium hypochlorite solution) will be applied at the Cosgrove Aqueduct to utilize travel time in the Cosgrove Aqueduct to achieve primary disinfection prior to corrosion control treatment and secondary disinfection. The facility will begin operation in 1999 and continue until the new permanent treatment facility is completed. If chlorination is selected as the permanent treatment option, the interim disinfection facility will be expanded for use as a permanent facility, with the possibility of a substantial construction cost savings. If another treatment alternative (ozonation or filtration) is

selected, the facility could be retained as an emergency disinfection facility.

Scope

Subphase	Scope
Study 1	Investigation of the potential impacts of SDWA amendments on the MWRA system and evaluation of the need, feasibility, and benefits of improved treatment processes.
Study 2	Evaluation of alternative filtration, disinfection, and corrosion control processes to determine which were most appropriate for MWRA source waters. Construction and operation of a pilot plant at the Wachusett Reservoir to allow testing of various treatment technique combinations. Identification of potential locations for constructing treatment facilities.
Open Reservoir Water Quality Study	Investigation of potential impacts on the open distribution reservoirs, resulting from: their replacement by new covered distribution reservoirs, and study of ways to maintain their water quality for emergency supply. Norumbega, Weston, Spot Pond, and Fells Reservoirs will be studied.
AWWARF Red Water Control Strategy Study	Evaluation of various treatment options for eliminating discolored water due to unlined cast-iron pipe. Also investigation of the fundamental aspects of iron chemistry and corrosion using unlined cast-iron pipe from MWRA community distribution system.
Crypto Inactivation Study	Determination of the site specific efficacy of inactivating *Cryptosporidium* in Wachusett Reservoir source water using disinfectant alternatives chlorine/chloramine and ozone/chloramine, and then development of design criteria for the full-scale disinfection contacting system.
Permit Fees	Permitting fees related to the various phases of this project.
Technical Assistance	Technical assistance for the water treatment plant.
EIR/Conceptual Design	Environmental reviews, data collection and analyses, facility designs to support the dual track compliance approach, evaluation of design criteria, site plans, plant hydraulics, and construction of a small scale demonstration water treatment plant.
Design/ESDC	Design and Engineering Services During Construction for a 405 mgd water treatment plant and other associated components.
WHCP-1 Wachusett and Cosgrove Intakes	Upgrade of the Cosgrove intake and powerhouse to allow automatic, unstaffed operation of the facility. Replacement of the valves and piping in the Wachusett intake required to allow flow required for this facility to service as a backup water supply.
WHCP-2 Wachusett Aqueduct Repairs	Crown repair and minor grouting to allow the Wachusett Aqueduct can service as a backup to the Cosgrove tunnel.
WHCP-3 Site work and Storage Tank	Clearing and excavation of platforms for the storage tank and chloramination building. Included bid alternative for clearing and excavating for the filtration alternative facilities should the DEP require filtration after this contract is awarded. Also includes site access yard piping, and the 50 million gallon storage tank.

WHCP-4 Treatment Facilities	Chloramination, corrosion control and emergency generator building, modifications to Shafts B and C, and MWRA Waterworks Transmission system wide instrumentation from Wachusett reservoir to Norumbega reservoir.
WHCP-5 Water Mains	Water mains to link the water treatment plant to Marlborough, Southborough, Northborough and Westborough State Hospital.
WHCP-6 Late Site Work	Final grading, landscaping, and paving.
Design Management Support	Professional service and value engineering support to MWRA staff in the design of the water treatment plant.
Construction Management/RI	Construction management support on-site during construction of the proposed water treatment plant.
Construction Interim Disinfection Facility	Construction of an interim facility at Shaft A of the Cosgrove Aqueduct in Clinton where free chlorine will be applied to provide necessary CT value for primary disinfection.

Quabbin Water Treatment Plant (543)

Purpose

To improve the quality of drinking water delivered to the three Chicopee Valley Aqueduct (CVA) communities of Chicopee, Wilbraham, and South Hadley Fire District No. 1, and to ensure that the water delivered meets the drinking water quality standards established by the federal Safe Drinking Water Act. Improvements will include construction of a corrosion control facility, disinfection facilities, and covered storage at Nash Hill Reservoir.

Project History and Background

Currently, MWRA provides water to the three CVA communities under long-term contracts with termination dates of 1998 (South Hadley) and 2000 (Chicopee and Wilbraham). The rates charged by MWRA under these contracts are less than ten percent of the current prevailing rate. MWRA and the communities are currently negotiating new agreements and rates.

Quabbin Reservoir is currently the source of water to the three Chicopee Valley Aqueduct communities. Massachusetts DEP has granted a conditional waiver from filtration for Quabbin Reservoir water. A consent order covering activities to support the continuation of the filtration waiver was signed by MWRA and DEP in December 1991. The consent order schedule for design and construction of permanent disinfection and corrosion control facilities, which are needed to comply with the federal and state drinking water standards, was submitted to DEP in February 1994. Under the consent order, the approved treatment processes for disinfection and corrosion control are chlorination for primary disinfection, chloramination for residual disinfection, and lime/carbon dioxide for corrosion control. The publication of new draft regulations for the Enhanced Surface Water Treatment Rule and Disinfectant/Disinfection By-Products Rule, and discussions regarding a possible *Cryptosporidium* rule have raised questions regarding the long-term efficacy of these treatment technologies, and may require future modifications.

MWRA has developed an action to plan for the possibility of future treatment requirements. The results of a life cycle cost analysis determined that the chlorine/chloramine is the most cost-effective treatment option, even if ozonation facilities or other treatment processes are required as soon as two years later. The current project construction budget is based on chlorination and chloramination.

Because the City of Chicopee recently constructed and placed into operation its own corrosion control facility, it may not be desirable or practical for the MWRA to build a central corrosion control facility to serve all three communities. It may be more cost-effective for MWRA and the communities to construct smaller facilities for Wilbraham and South Hadley Fire Department No. 1, or for the communities to construct their own corrosion control facilities. A feasibility study and LCCA will be prepared to identify the most cost-effective alternative. It is anticipated that baking soda/soda ash

would be utilized for the small corrosion control facilities.

This project also includes the final design, construction administration, and resident inspection services for monitoring and control upgrades of the Bondsville Throttling Station and other CVA appurtenances. Cost of permitting for associated communications equipment and facilities in the CVA system is also included. The preliminary design of the Bondsville project has been completed in-house. Presently, in the CVA system is operated manually in the same manner as when it was originally constructed fifty years ago, and has no monitoring and control capability. This capability has been added to the Quabbin designer's scope, because the work is consonant with other design tasks. In addition, the monitoring and control upgrades need to be completed in a timely manner to provide operational control of the CVA during construction of the disinfection facilities and the covered storage tanks. Funds for construction of Bondsville Throttling Station upgrade were previously included in the budget for the Central Monitoring System Expansion project.

Scope

Subphase	Scope
Quabbin WTP: Design/CA/RI	Includes a system hydraulics study, preliminary design, design, construction administration, and resident inspection for a corrosion control facility and disinfection facilities (the design budget was originally scoped for an ozone facility; negotiations are underway to reduce the contract amount to reflect the current scope for a disinfection facility).
Land	Acquisition of two plus acres of land for siting disinfection facilities.
Quabbin WTP: Construction	Construction of disinfection facilities.
DEP Permit Fee	Department of Environmental Protection permit fees for required construction.
Design/Construction (Communications System)	Design and construction of a wireless communication system which will facilitate automation of the new treatment facilities, Nash Hill storage tanks, and the Bondsville Throttling Station and allow remote operation of the entire CVA system from the Operations Control Center.
Monitoring and Control	Subphase moved from Central Monitoring and Control project to this project, and expanded to include monitoring and control improvements for the Bondsville Throttling Station and the Nash Hill Covered Storage project.
Utility Relocation for Quabbin WTP	Relocation of electric and telephone overhead utility lines and poles for construction and operation of the two new treatment facilities.

Watershed Protection (541)

Purpose

To develop watershed protection plans and implement protection measures for the MWRA/MDC reservoir system.

Project History and Background

Sudbury Reservoir Watershed Protection Plan

MWRA and MDC have completed watershed protection plans for the Wachusett and Quabbin/Ware watersheds. Implementation of these plans by the MDC and MWRA is ongoing and is a major component of MWRA's dual-track approach to Wachusett water treatment planning. This project consists of two additional components: development of a Sudbury Reservoir Watershed Protection Plan, and MWRA's contribution to MDC's Wastewater Facilities Plan for the Wachusett Reservoir watershed. There currently is no water quality management or protection plan for the Sudbury Reservoir system, which is MWRA's only back-up supply, and threats to water quality have proliferated in the past two decades. The protection plan, completed in April 1997, will provide guidance to MDC on future policy and management decisions regarding water quality protection. The wastewater facilities plan consists of providing sewer service to critical portions of the towns of Holden and West Boylston to protect Wachusett Reservoir water quality.

The Sudbury Reservoir system, which includes the Sudbury reservoir and Framingham Reservoir #3, is the only back-up water service in the MWRA system. The reservoirs are located in Southborough, Marlborough, and Framingham, and their watersheds incorporate portions of Westborough, Northborough, and Ashland. Although the Sudbury Reservoir has been on reserve status since 1974, it remains an essential emergency response component for the waterworks system.

The Sudbury Reservoir could function either as a direct source of supply to the metropolitan area for up to one month (in case of an interruption in flow from Wachusett Reservoir) or as a transmission channel to convey a mixture of Wachusett-Sudbury water through to the Sudbury Aqueduct or Weston Aqueduct (in case of a failure along the Hultman Aqueduct).

The Sudbury Reservoir has a long history of water quality problems, and any contemporary use for drinking water might trigger issuance of a public health advisory and/or boil order. Furthermore, since the reservoir's deactivation in 1974, there has been little attention given to watershed protection. As a result, the watershed has become more developed during the past two decades and sources of pollution have increased. These factors have raised concerns about the long-term viability and usefulness of the Sudbury Reservoir as a drinking water resource.

West Boylston/Holden Sewer

MDC is implementing a $58 million wastewater facilities plan for portions of Holden and West Boylston in the Wachusett Reservoir watershed. A wastewater collection system will replace failing or marginal septic systems and has been identified as a top watershed protection priority by MWRA, MDC, DEP, and EPA. Construction of 72 miles of sewer pipe is planned, with sewage conveyed to and treated at the Upper Blackstone Water Pollution Control Facility.

A cost sharing formula for the project between the Commonwealth of Massachusetts, the towns of Holden and West Boylston, and MWRA was approved in the fall of 1995, after six months of negotiations.

Scope

Subphase	Scope
Sudbury Reservoir Protection Study	Documentation of current conditions in the watershed and development of a reasonable strategy for maintaining acceptable water quality.
West Boylston / Holden Sewer	MWRA's share of the cost of implementing the MDC's wastewater facilities plan in the Wachusett Reservoir Watershed.

Norumbega Covered Storage (544)

Purpose

To help provide high quality drinking water to MWRA customers and to ensure that the water meets the drinking water quality standards established by the federal Safe Drinking Water Act (SDWA) by constructing a 115-million gallon covered storage facility at Norumbega Reservoir.

Project History and Background

Norumbega Reservoir is an uncovered distribution storage reservoir connected to the Hultman Aqueduct in Weston. It provides active distribution storage and hydraulic control for approximately 85 percent of the water supplied to the metropolitan Boston area. The reservoir has capacity of 205 million gallons and a surface area of approximately 40 acres.

DEP, MWRA, and MDC entered into a consent order on June 11, 1993 for the Wachusett Reservoir water supply. This consent order requires MWRA to bring Norumbega Reservoir into compliance with state and federal regulations. Based on an amendment to the consent order dated February 12, 1998, Norumbega Reservoir must be in compliance (construction of two cells of covered storage facilities shall be substantially complete and the open reservoir removed from service) by December 2003. The third tank cell and final site work will be completed by December 2004. To meet the terms of the consent order, MWRA plans to construct distribution storage, connect to planned transmission system improvements, and provide associated facilities in the vicinity of Norumbega Reservoir. The project site is located immediately south of the Massachusetts Turnpike (Mass Pike) in Weston, bounded on the east, south, and west by Oak Street, the Hultman Aqueduct right-of-way, and Wellesley Street, respectively.

The primary component of the project is installation of 115 million gallon reinforced concrete storage tank west of Schenk's Pond, between Norumbega Reservoir and the Mass Pike, on land previously owned by the Town of Weston and the Weston Forest and Trail Association (WFTA). The tank will cover approximately 19 acres, and will store water which has been fully treated at the Walnut Hill Water Treatment Plant. It is planned to integrate start-up of the new covered reservoir with the start-up of the MetroWest Water Supply Tunnel.

Disinfection facilities will be maintained on-site for emergency use in the event that it is necessary to draw water directly from the open Norumbega Reservoir and/or Schenck's Pond. Chlorine will be applied at the Norumbega gate house.

Scope

Subphase	Scope
Norumbega: Preliminary Design/EIR	Environmental reviews, data collection and analyses, and preliminary designs for covered storage at Norumbega Reservoir.
Norumbega: Owner's Representative	Owner's representative, technical program management advisor services for Norumbega covered storage Design/Build contract procurement and monitoring.
Norumbega: Design/Build	Design and construction by a single contractor of a 115 million gallon covered storage facility at the Norumbega Reservoir.
Land	Land acquisition for Norumbega Covered Storage.
Appraisal	Appraisal of land for Norumbega Covered Storage.

Nash Hill Covered Storage (548)

Purpose

To help improve the quality of drinking water delivered to the three Chicopee Valley Aqueduct communities of Chicopee, Wilbraham, and South Hadley Fire District No. 1, and to ensure that the water delivered meets the drinking water quality standards established by the federal Safe Drinking Water Act by constructing covered storage at Nash Hill Reservoir.

Project History and Background

Open reservoirs within the water distribution system are considered primary water supply sources under the Safe Drinking Water Act and are therefore subject to the Surface Water Treatment Rule. In addition, state regulations require that all open distribution reservoirs be covered to prevent airborne, land, and water-borne contamination or that the water be treated in compliance with the surface water treatment rule. In order to comply with the December 1991 consent order between MWRA and the Massachusetts DEP, the MWRA must provide covered distribution storage at the Nash Hill Reservoir by October 1999.

Nash Hill Reservoir is a single, undivided, uncovered, man-made basin that is connected to the Chicopee Valley Aqueduct in the Town of Ludlow. The reservoir was constructed in 1950, and provides distribution storage and hydraulic control for water supplied from Quabbin Reservoir to Chicopee, Wilbraham, and South Hadley Fire District No. 1. Nash Hill Reservoir has a total capacity of approximately 25 million gallons, a surface area of approximately five acres, and a maximum depth of approximately 20 feet. This open reservoir is will be replaced by two 12.5 million gallon covered tanks.

Scope

Subphase	Scope
Preliminary Design	Study to determine the most suitable type of covered storage, and preliminary design of preferred alternative.
Design/CA/RI	Design, construction administration, and resident inspection of two covered storage tanks.
Construction	Construction of two pre-stressed, precast 12.5 million gallon flat roof storage facilities at the reservoir.

Blue Hills Covered Storage (545)

Purpose

To provide sufficient distribution storage for the Southern High service area. Presently, the area has no active or emergency storage, creating the potential for supply disruption if repairs are needed on a major transmission line for Quincy and communities to its south. Covered distribution storage will equalize pressure at the extremities of the Southern High pressure zone and provide emergency storage for unexpected interruptions of supply. New covered storage facilities at the Blue Hills Reservation will have a storage capacity of 25 million gallons.

Project History and Background

Blue Hills Reservoir is a currently inactive open distribution reservoir. Based on a recently completed engineering study, MWRA's long-term plan is to provide 400 million gallons of enclosed storage at various locations throughout the waterworks system. This quantity represents approximately one day of maximum demand. The study identified the need for a covered storage facility at this location to work in conjunction with Section 22 to supply water for the Southern High System in the event that the Dorchester Tunnel requires repairs and to supply water to Quincy in the event that the northern portion of Section 22 is shut down because of a break or for repairs. Members of a working group involved in the EIR/Preliminary Design process to date have recommended a 25-million gallon facility, and are currently examining site and facility configuration alternatives.

Scope

Subphase	Scope
EIR/Preliminary Design	Preliminary design of a 25-million gallon covered storage facility and MEPA environmental review.
Final Design	Final design of the facility.
Construction	Construction of the facility.
DEP/Permit Fees	Department of Environmental Protection permit fees for required construction

Bear Hill Covered Storage (546)

Purpose

To provide an additional storage facility for the Northern Intermediate High System to ensure adequate water pressures and to facilities necessary maintenance of the existing Bear Hill tank. Construction of a new six-million gallon covered storage facility near the existing tank will double available storage for the Northern Intermediate High System.

Project History and Background

Presently, the MWRA pumps water from the Spot Pond Pump Station to the Bear Hill Tank in Stoneham which serves the Northern Intermediate High Service communities of Stoneham, Wakefield, and Woburn.

The existing Bear Hill covered storage facility has a capacity of six million gallons and does not provide sufficient emergency storage for the service area. In addition, MWRA cannot deactivate the tank for necessary cleaning and maintenance without disrupting service.

Scope

Subphase	Scope
Feasibility / EIR/Preliminary Design	Preparation of an environmental impact report and preliminary design for the six-million gallon covered storage facility.
Final Design/CA/RI	Final design, construction administration, and resident inspection for the construction of the facility.
Construction	Construction of the facility.

Fells Reservoir Covered Storage (547)

Purpose

To provide covered storage for the Northern High Service distribution system by constructing a 20-million gallon covered storage tank at the Fells Reservoir in Stoneham.

Project History and Background

Fells Reservoir is one of the several distribution reservoirs maintained by the Waterworks Division for storage of water supply transported from the source reservoirs. The Fells Reservoir provides water to Melrose, Stoneham, Wakefield, and other communities in the northeast portion of the Northern High Service area.

Open reservoirs within the water distribution system are considered primary water supply sources under the Safe Drinking Water Act and are therefore subject to the Surface Water Treatment Rule. In addition, state regulations require that all open distribution reservoirs be covered to prevent airborne, land, and water-borne contamination. On June 11, 1993, MWRA, MDC, and Massachusetts DEP signed a consent order which stipulates that covered storage be provided at Fells Reservoir by December 31, 1998. The schedule included in the current CIP for completion of construction of the Fells Reservoir covered storage facility is consistent with this order. The May 1999 substantial completion milestone for construction extends beyond December 1998 because of incidental pipe work included in the construction contract.

This project involves installation of a 20-million gallon covered storage facility at the Fells Reservoir. Work includes rock excavation and foundation work; installation of intake and overflow lines; installation of the tank walls, floor, and roofing; and backfill and landscaping.

In response to DEP concerns about the potential for cross contamination between the open reservoir basins and the distribution system piping at the bottom of the reservoir. MWRA has amended the project scope to include new 36-inch water mains to replace existing 50- and 100-year old mains.

Scope

Subphase	Scope
Design/CS/RI-Fells Reservoir	Design, construction services, and resident inspection for installation of a 20-million gallon covered storage facility at the reservoir.
Construction-Fells Reservoir	Installation of a 20-million gallon buried, reinforced concrete covered storage facility at the reservoir.
DEP Permit Fees	Department of Environmental Protection permits for construction of the pump station and facilities.

Bellevue Additional Storage (549)

Purpose

Hydraulic analysis and operational problems indicate the need for additional storage capacity for the Southern Extra High Service Area. Construction of the new tank will increase capacity and meet projected current and future demand.

Project History and Background

Hydraulic analysis and operational problems have demonstrated the need for additional storage capacity for the Southern Extra High Service Area. The existing tanks servicing this area have limited capacity and are not totally available due to their low elevation.

This project will provide a new 3.6 million gallon tank to provide additional storage capacity allowing for more efficient operation of service area pumping stations because of less dependence required to meet demand.

The ongoing rehabilitation of the Newton Street and Hyde Park Pumping Stations and associated suction and discharge piping, which service the Southern Extra High Service Area will be completed in 2004. These improvements will alleviate the current restricted water supply and distribution capability. However, using the pumping station to meet the needs will be inefficient, and will not provide and acceptable level of system redundancy. As system demand grows, the need for this additional storage capacity will increase, requiring this water storage by 2018.

Scope

Subphase	Scope
Preliminary Plan/EIR	The preliminary plan for tank siting and necessary environmental studies and public review.
Final Design/CS/RI	Design, construction services, and resident inspection for the construction of a 3.6 million gallon water storage tank.
Construction	Construction of a 3.6 million gallon water storage tank.

Low Service Storage Near Spot Pond (550)

Purpose

A new storage facility is required to meet the Drinking Water Guidelines and Policies mandate to provide a one-day supply of storage and to remove the Weston Low Service and Spot Pond open reservoirs.

Project History and Background

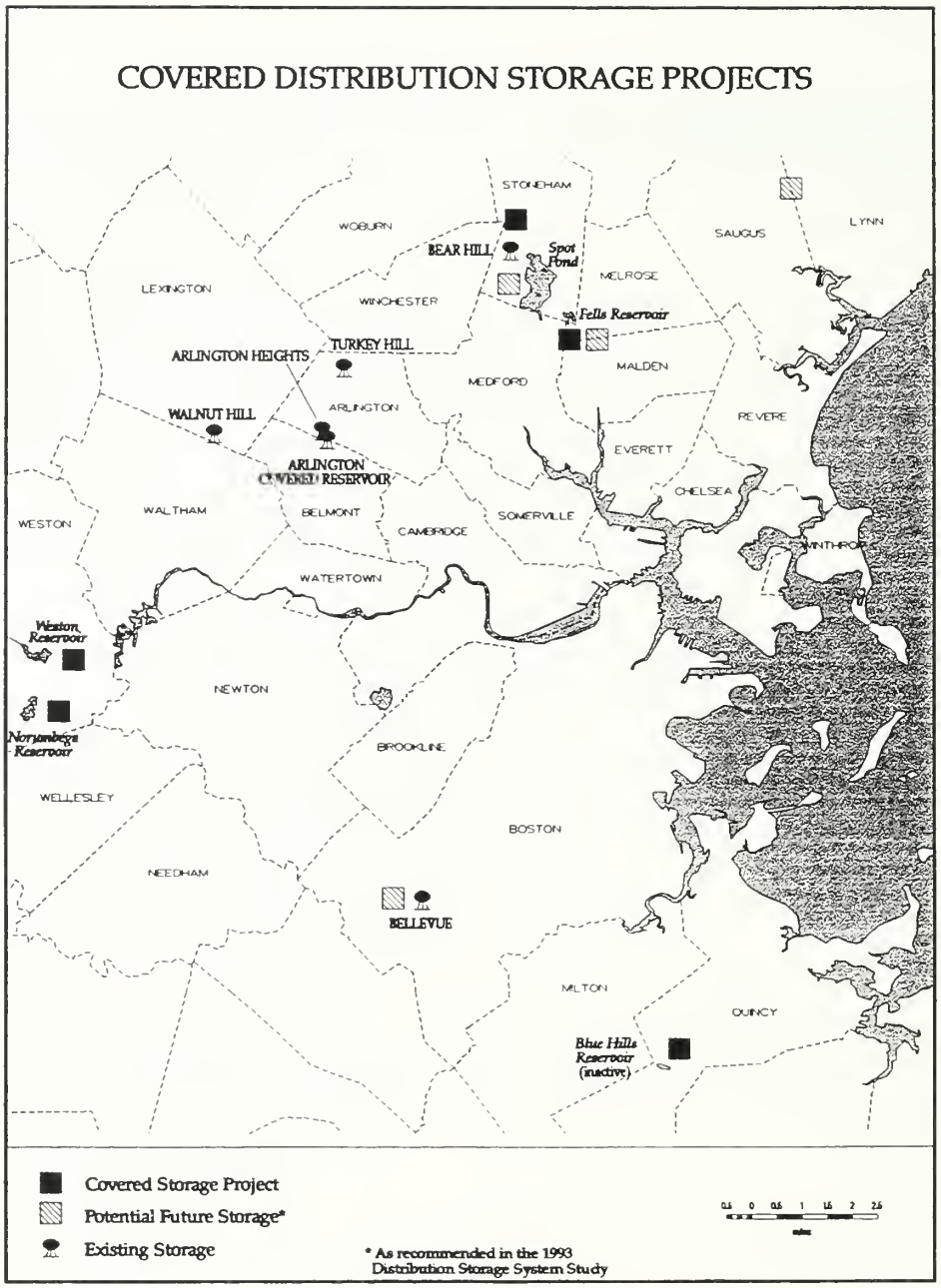
A new 20 million gallon covered storage facility to provide distribution storage for the Low Service area is required primarily due to the vulnerability of Spot Pond, water quality problems, and the removal of Spot Pond as a water source in 1997. The new Spot Pond Pipeline, Section 99, will supply the pump station, however covered storage should be provided for the Low Service area in the vicinity of Spot Pond to meet the demand for normal and emergency operations.

It is expected that rectangular cast in place concrete tanks would be construction at an elevation of approximately 180 feet, which is 16 feet higher than the present water level at Spot Pond.

This project will augment the Northern High Service are on an emergency basis through the Spot Pond Pumping Station.

Scope

Subphase	Scope
Preliminary Plan/EIR	The preliminary plan for tank siting and necessary environmental studies and public review.
Final Design/CS/RI	Design, construction services, and resident inspection for the construction of a 20 million gallon water storage tank.
Construction	Construction of a 20 million gallon rectangular cast in place concrete tanks.


COVERED DISTRIBUTION STORAGE PROJECTS
STONEHAM
WOBURN
BEAR HILL
Spot Pond
SAUGUS
LYNN
LEXINGTON
WINCHESTER
MELROSE
Fells Reservoir
TURKEY HILL
ARLINGTON HEIGHTS
MALDEN
MEDFORD
WALNUT HILL
ARLINGTON
REVERE
EVERETT
ARLINGTON COVERED RESERVOIR
CHELSEA
WALTHAM
BELMONT
SOMERVILLE
WESTON
CAMBRIDGE
WINTHROP
WATERTOWN
Weston Reservoir
NEWTON
Norumbega Reservoir
BROOKLINE
WELLESLEY
BOSTON
NEEDHAM
BELLEVUE
MILTON
QUINCY
Blue Hills Reservoir (inactive)
Covered Storage Project
Potential Future Storage*
Existing Storage
* As recommended in the 1993 Distribution Storage System Study

MetroWest Water Supply Tunnel (604)

Purpose

To provide transmission redundancy for the Hultman Aqueduct to ensure reliable water delivery and to provide sufficient hydraulic capacity to support the new Walnut Hill Water Treatment Plant and covered storage distribution facilities. This project consists of construction of a 17.5 mile deep rock tunnel from Shaft C in Marlborough to Shaft 5 of the City Tunnel in Weston.

Project History and Background

MWRA's water delivery depends on a system of tunnels and aqueducts which transport water from the Quabbin and Wachusett Reservoirs to the distribution reservoirs in western metropolitan Boston. The existing tunnels and aqueducts are deficient in several respects. First, the transmission system is unable to supply sufficient hydraulic capacity during peak flow periods, leading to pressure deficiencies in all high service areas during the summer months. Second, key sections of the transmission system, such as the Hultman Aqueduct and the Southborough Tunnel, rely on a single conduit. In the event of failure of any of the major transmission sections, the remaining waterworks system could not meet the demand for water.

Redundancy planning and the need to provide adequate transmission capacity to support the integrated system plan for improving drinking water quality is the prime reason for transmission system improvements.

Construction of the MetroWest Water Supply Tunnel and its extension to the Weston Aqueduct Terminal Chamber, will provide the critically needed minimum level of transmission redundancy for the Hultman Aqueduct. Redundancy for the City Tunnel and the City Tunnel Extension will be planned for as part of the Metropolitan Tunnel Loop project. Redundancy will also enhance system maintenance by allowing each major supply conduit to be taken out of service for inspection, cleaning, and repair.

The project includes a study of the aqueduct/tunnel system; EIR, design, and replacement of the Sudbury Aqueduct and the Weston Aqueduct with the MetroWest Tunnel; design and construction of the new Loring Road water storage facility in Weston; a condition assessment study of the existing Hultman Aqueduct; and design and implementation of a local water supply contingency plan to provide water service to property owners affected by tunnel construction.

The Marlborough, Southborough, Framingham, Wellesley, Needham, and Weston distribution systems are supplied in part or entirely by pumping stations which take suction from the Hultman Aqueduct. The Town of Northborough and Westborough State Hospital, which both take water from the Wachusett Aqueduct, also require alternative connections. Alternative means of delivering

water to these users are essential so that the Hultman may be taken off line for inspection, maintenance, and repair.

In June 1989, MWRA began engineering work on reconstruction of the Sudbury Aqueduct. Design began as an evaluation of three options: surface reconstruction of the aqueduct with a ten-foot diameter pipe or equivalent with new tunnels to connect it to the existing aqueduct system; surface reconstruction with tunnel alternatives to the pipe in areas of dense urban development or other sensitive areas such as wetlands, hazardous waste sites, etc.; and an all-tunnel alternative for the length of the project.

On May 9, 1990, the Board of Directors directed staff to put minimum effort into further study of the Sudbury Aqueduct reconstruction alternatives and maximum effort into study of the all-tunnel alternative. The advantages of tunneling included a large reduction in surface activities resulting in a reduced environmental impact, and the potential to obtain a large increase in water transmission capacity to enable the tunnel to supplant the Weston Aqueduct as well as the Sudbury Aqueduct. Other advantages included a higher pressure rating by constructing a tunnel deeper into rock, and the ability to construct along a straight line, reducing the overall length of the project by three miles.

In November 1990, the Board of Directors directed staff to eliminate the planned tunnel from Norumbega Reservoir to the Chestnut Hill Reservoir in favor of connecting Shaft 5 of the City Tunnel and to the eastern end of the Weston Aqueduct. The connection will allow the Weston Aqueduct and Weston Reservoir to be taken off-line and used only for emergency supply as required by the Safe Drinking Water Act.

Program Elements

The MetroWest Tunnel Project consists of a new 14-foot diameter, 17.5-mile long tunnel. The first segment of the tunnel will extend from the water treatment plant site at Walnut Hill in Southborough to Shaft 4 of the Hultman Aqueduct in Southborough. From there, the tunnel will continue to a "WYE" connection east of Norumbega Reservoir, and will continue east from the "WYE" to Shaft 5 of the City Tunnel and northward to the Weston Aqueduct Terminal Chamber. The tunnel depth will vary from 200 to 500 feet below ground surface along the alignment (see Transmission System Redundancy Plan at the end of this project narrative).

Following start-up of the MetroWest Tunnel, the Hultman Aqueduct will be inspected and rehabilitated to repair any observed leaks. Surface distribution facilities, including piping, valve chambers, and risers will connect the tunnel to the Hultman Aqueduct and local community services. Intermediate connections between the MetroWest Tunnel and the Hultman Aqueduct will permit operation of segments of either the aqueduct or the tunnel interchangeably, allowing flexibility in the maintenance of the two conduits.

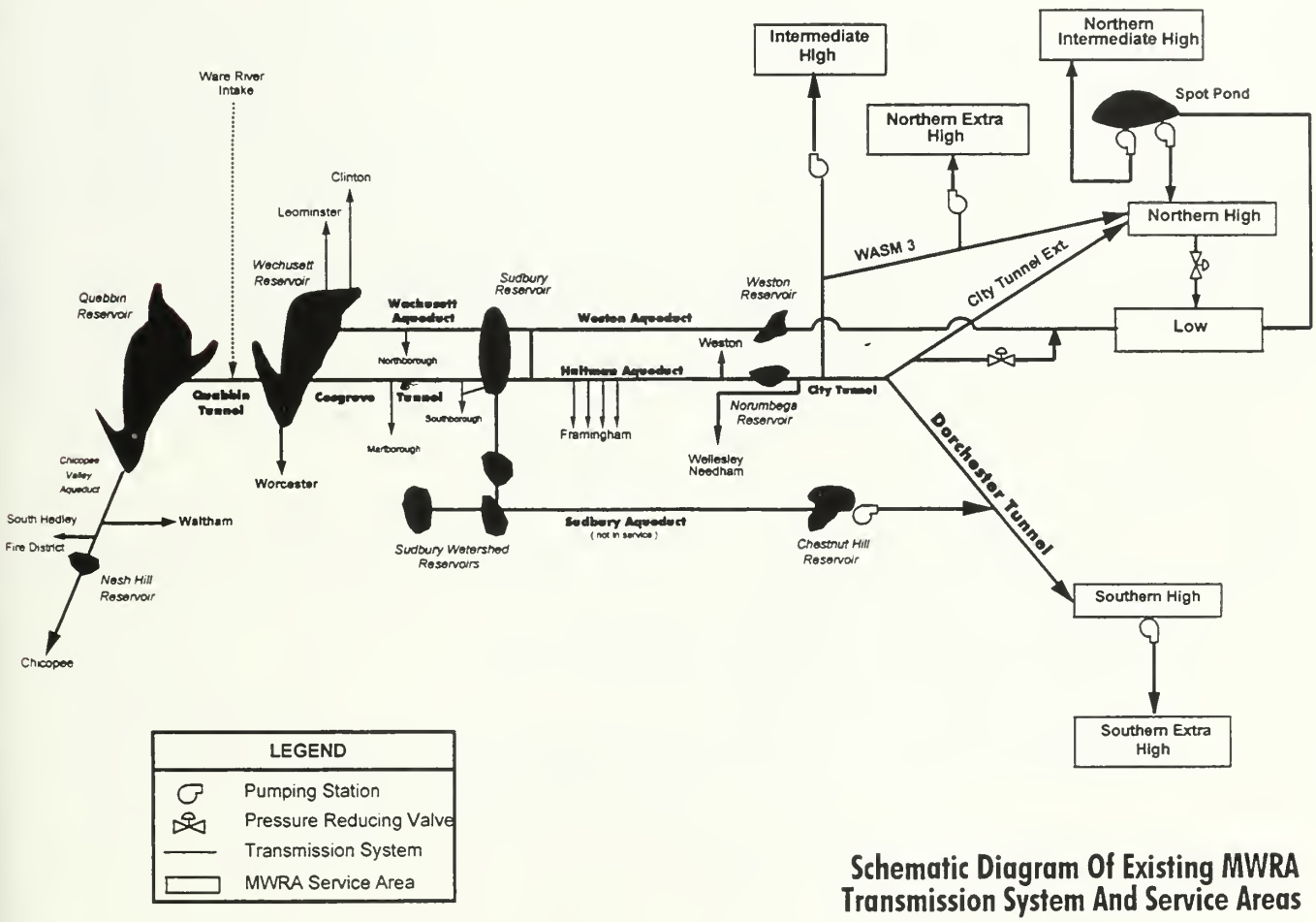
The MetroWest Tunnel and the proposed version of the Metropolitan Tunnel Loop are illustrated on the last page of the narrative for this project.

Scope

Subphase	Scope
Study	Study of the aqueduct/tunnel system to determine the best course of action to improve hydraulic capacity and create redundancy.
Construction-Siphon Pipe Bridge	Rehabilitation of the Siphon Pipe Bridge at the Weston Aqueduct which experienced significant leakage.
Design/EIR-Tunnel-Engineering Services During Construction (ESDC)	Environmental impact process and design of the 17.6-mile long, 14-foot diameter tunnel. Construction support services, including environmental and safety compliance, claims assistance, contract administration, quality assurance testing, and community relations.
Construction: Western Tunnel Segment - CP1	Construction of the western portion of the tunnel and associated surface facilities. Shaft E will be constructed at the Sudbury Dam and a tunnel will be excavated 4.9 miles to Shaft D, located adjacent to the clear well of the Walnut Hill Water Treatment Plant (WTP). A riser shaft will be constructed to connect the tunnel to Southborough's Hosmer Pump Station. The surface piping facilities necessary to bring water from the Wachusett Aqueduct and the Cosgrove Tunnel to the WTP will be part of the WTP project.
Construction: Middle Tunnel Segment - CP2	Construction of approximately 11.9 miles of tunnel between Southborough and Weston. Construction will be staged from Shaft L, located at a sand and gravel pit in Framingham, where a permanent connection to the Hultman will be constructed. Along the alignment, four small-diameter shafts will be constructed for community connections to Framingham and Weston. The western reach of the CP-2 portion of the tunnel will terminate at Shaft E. The eastern reach will terminate at the "WYE" of Shaft W and Shaft 5A. Shafts NE and NW will be constructed on the east side of Norumbega Reservoir where surface work will include valve chambers and surface piping to allow connections to the Hultman Aqueduct and Norumbega Reservoir. The design at Shaft N includes provisions for future connections to the Norumbega Covered Storage facility and the proposed Metropolitan Tunnel Loop.
Construction: Shaft 5A- CP3	Shaft 5A is located near the intersection of Route 128 and the Massachusetts Turnpike. From Shaft 5A, an approximately 2,000-feet long, 12-feet finished diameter tunnel will be constructed westward to connect to the Contract 2 tunnel at the "WYE".
Construction: Eastern Tunnel Segment - CP3A	Construction of the eastern portion of the tunnel. An approximately 4,400-feet long, 12-feet finished diameter tunnel will be constructed from the Shaft 5A bottom through the "wye" and onto the constructed Shaft W where shaft connection to Loring Road Storage Tanks will be made.
Construction: Surface Work - CP4	Filed sub-bid work for the MetroWest Tunnel project has been grouped under one contract. This includes work at Norumbega Reservoir such as chemical feed facilities, and piping. This contract also includes filed sub-bid work at other MetroWest locations such as electrical work at Shaft E and a meter replacement for the Wellesley Street Pump Station.
Construction: MHD Salt Sheds - CP5	Massachusetts Highway Department (MHD) salt storage operations have been transferred from the Shaft 5A site to a new, nearby location on MHD property on Recreation Road in Weston. This has allowed demolition of the MHD salt sheds at the Shaft 5A site. New salt storage sheds and site grading work have been completed under this contract at the Recreation Road site.

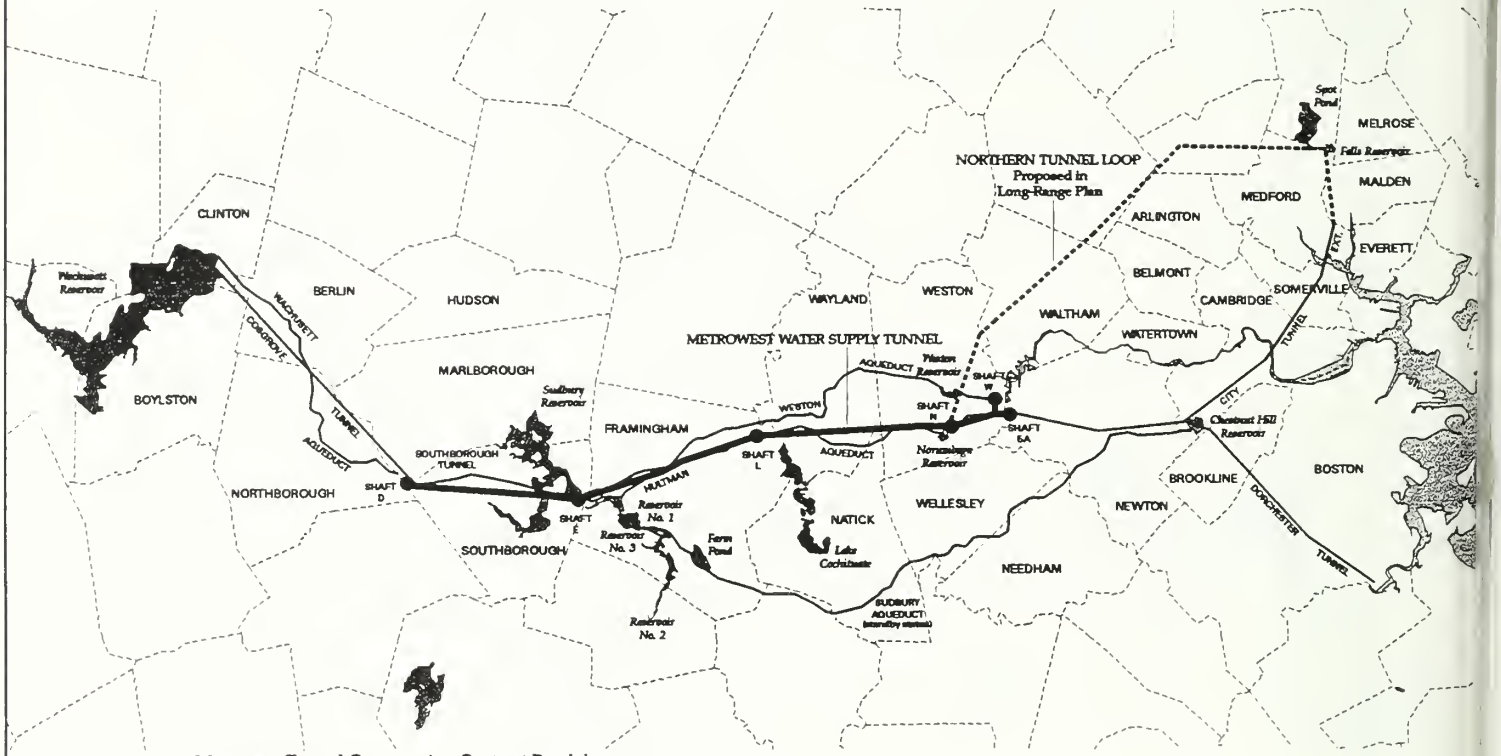
Construction: Hultman Interconnection/ Inspection - CP6	Full inspection and partial rehabilitation of the Hultman Aqueduct, followed by construction of interconnections from the MetroWest Tunnel to the Hultman Aqueduct at Shafts L, 5A, N, and E, as well as a buried connections to the Hultman Aqueduct from Valve Chamber E-2, Valve Chamber E-3, Meter Vault 4, and the access road from Valve Chamber E-2 to Meter Vault 4.
Construction: Testing & Disinfection - CP7	Pressure testing of the MWWST from Shaft E (west) to Shaft W and 5A, and disinfection of the entire tunnel from Shaft D to Shafts W and 5A.
Construction: Loring Road Covered Storage- CP8	Construction of surface facilities at the Shaft W site including a 20-million gallon storage facility that will replace the function of the existing Weston Aqueduct/Weston Reservoir system, allowing the Weston Aqueduct/Reservoir system to be taken off-line and placed on emergency stand-by status. The storage facility will be constructed as two concrete tanks partially buried in a hillside adjacent to Shaft W. Connections will be made under this contract at Shaft W to three WASM Low Service mains and a single WASM High Service main, as well as to the seven-feet diameter branch of the Hultman Aqueduct. Rehabilitation of 4,100 linear feet of 60-inch pipe and four master meters.
Construction Management/ Resident Inspection	Full inspection of all construction elements, as well as provision of construction support services including environmental and safety compliance, claims assistance, contract administration, quality assurance testing, and community relations, and engineering services during construction, including review of technical submittals by the construction contractor and provision of technical assistance.
Hultman Study	Risk analyses to determine which leaks should be repaired now and a monitoring plan for leaks which presently do not threaten the integrity of the aqueduct.
Hultman Leak Repair	Test pit excavation and leak repair on the Hultman Aqueduct.
Hultman Repair Band	Purchase of external repair band for Hultman Aqueduct repair.
Land Acquisition	Easements along the 17.5-mile tunnel construction route, as well as land at the Shaft W and Shaft L sites.
Professional Services	Services such as construction safety, contractor audit, legal services, risk management consulting services, and other miscellaneous services.
Community Technical Assistance	Funds to assist communities with the planning and redesign of utility plans.
Local Water Supply Contingency Design/CA/RI	Design of a Water Supply Contingency Plan including the installation of new local mains where residential well supplies could be affected by tunnel construction.
Local Water Supply Contingency Construction	Construction phase of the Water Supply Contingency Plan, including installation of local mains where residential well supplies are affected by tunnel construction.

Local Water Supply Contingency Easements	Legal easements necessary for implementation of the Water Supply Contingency Plan.
Owner Controlled Insurance	Owner controlled insurance program providing workers compensation, general liability, and pollution liability insurance for MetroWest construction contracts 1 - 8.
Framingham MOU	Funds to mitigate the impacts of the construction of the MetroWest Water Supply Tunnel with the Town of Framingham.
Weston MOU	Funds to mitigate the impacts of the construction of the MetroWest Water Supply Tunnel with the Town of Weston.
Southborough MOU	Funds to mitigate the impacts of the construction of the MetroWest Water Supply Tunnel with the Town of Southborough.



Schematic Diagram Of Existing MWRA Transmission System And Service Areas

Transmission System Redundancy Plan



Metrowest Tunnel Construction Contract Breakdown

CP1 Western Tunnel Segment from Shaft E to Shaft D
CP2 Middle Tunnel Segment from Shaft E to the "wye" east of Norumbega
CP3 Shaft 5A and Horizontal Bore
CP3A Eastern Tunnel Segment from "wye" to Shaft W and Shaft 5A
CP4 Filed sub-bid surface work
CP5 Relocation of MHD salt sheds at Shaft 5A
CP6 Hultman interconnections and inspection/rehabilitation
CP7 Tunnel testing and disinfection
CP8 Weston covered storage tanks

Dam Control Valve Replacement (599)

Purpose

To improve the safety and operability of water release valves needed for flood control functions and minimum stream flow requirements. Improvements include replacement of valves at Sudbury Reservoir in Southborough and at the Wachusett Dam.

Project History and Background

MWRA is responsible for the operation and maintenance of outlet control valves at the Wachusett Dam and Sudbury Reservoir in Southborough. The valves are used for flood control releases as well as for filling the Wachusett Aqueduct, which serves Northborough and Westborough State Hospital, and under emergency conditions would flow into the Hultman Aqueduct. In the past, both the Division of Waterways and the U.S. Army Corps of Engineers have cited the poor condition of the valves and the need to restore operability for flood control. Failure to make repairs could increase the risk of casualties and property damage if flood conditions should arise as well as lead to the downgrading of safety condition assessments of the Wachusett Dam by the Corps of Engineers.

Eight 24-inch valves control the water releases from the Sudbury Reservoir in Southborough. The valves were installed in 1841 to allow water to be released to either the Weston Aqueduct or Framingham Reservoir No. 3. The inoperable valves presently affect both routine operation and emergency flood control.

Scope

Subphase	Scope
Design - Wachusett	Design for the replacement of eight 24-inch diameter and four 48-inch diameter outlet control gate valves.
Construction - Wachusett	Replacement of eight 24-inch diameter and four 48-inch diameter outlet control gate valves.
Design - Sudbury	Design for the replacement of eight 24-inch valves.
Construction - Sudbury	Replacement of eight 24-inch valves.

Sluice Gate Rehabilitation (601)

Purpose

To improve the condition, operability, and access to sluice gates used to regulate the release of water from upstream reservoirs, streams via aqueducts in accordance with legislative and flood control requirements. Manual gates will be replaced by motorized gates and 12 facilities will be rehabilitated at Sudbury Reservoir, Framingham Reservoir, Spot Pond, and various locations along the Sudbury Aqueduct.

Project History and Background

The Waterworks Division is responsible for the maintenance and operation of the sluice gates and facilities that house the gates at reservoirs and aqueducts located throughout the system. The existing gates are typically 80 - 100 years old, are in poor condition, and must be operated by hand, a time consuming process that can require as many as 100 turns by the gate operator to fully open or close a single gate. Problems include gate leakage and corroded tracks which can prevent operation of the gates. In a Dam Safety Inspection Report by the Army Corps of Engineers, the sluice gates at Wachusett Reservoir and the four Sudbury System Reservoirs were cited as needing repairs to restore operability for flood control use. Failure to make repairs could lead to the Corps downgrading of dam safety assessments at these sites. In addition, the structural condition of some of the facilities is such that they are unsafe for access by Waterworks personnel for operation and maintenance purposes. To prevent further deterioration and, to provide safe access to and reliable operation of the sluice gates, it is imperative that the facilities be rehabilitated in conjunction with the replacement of the gates.

Scope

Subphase	Scope
Design-Stop Planks	Design of the stop planks for all sites.
Construction - Stop Planks	Construction of stop planks at all sites (required to de-water the wet wells) before the sluice gates can be installed.
Design/CS/RI 1	Design of the installation of motorized operators, upgrade of the gate houses, and replacement of gates and sliding tracks at Sudbury Reservoir, Spot Pond, and Framingham Reservoir 3.
Construction 1	Installation of motorized operators, upgrade of gate houses, and replacement of gates and sliding tracks at Sudbury Reservoir, Spot Pond, and Framingham Reservoir 3.
Design 2	Design of the installation of motorized operators, upgrade of the gate houses, and replacement of approximately 30 gates and sliding tracks at various distribution reservoirs.

Construction 2	Installation of motorized operators, upgrade of gate houses, and replacement of approximately 30 gates and sliding tracks at various distribution reservoirs.
Construction - Sudbury Toe Drain Repair	Payment to the MDC for construction of new toe drains, filter blanket and pressure relief wells, repair or abandonment of existing toe drains, and repair of the stone masonry spillway, dam crest roadway, gate house, and wing walls.

Metropolitan Tunnel Loop (614)

Purpose

To evaluate the need for and means of providing full redundancy for the City Tunnel, Dorchester Tunnel, and the City Tunnel Extension in order to ensure reliable transmission capabilities and allow for inspection, maintenance, or repair of these facilities if required. Current plans recommend a closed loop tunnel system, as originally planned in 1936 by the system's designers, created by constructing a 16.5-mile deep rock tunnel from Norumbega Reservoir in Weston to Fells Reservoir and the City Tunnel Extension, called the Northern Tunnel Loop. A supplemental, or even alternative, plan would be a southern tunnel loop from Norumbega Reservoir to Blue Hill Reservoir and the Dorchester Tunnel. Because this study will examine both northern and southern routes as well as other alternatives, it has been designated the "Metropolitan Tunnel Loop."

Project History and Background

When the pressure aqueduct system was planned in 1936, it was envisioned that the tunnel within the metropolitan area would be configured as a loop consisting of several segments so that any section could be deactivated while the others remained in service. This tunnel system was initially to have a northern loop and ultimately a southern loop.

The City Tunnel and the City Tunnel Extension have no high service backup facilities other than the Spot Pond Pump Station, and these tunnels cannot be removed from service for inspection, maintenance, or repair. Major high service transmission mains along the Dorchester Corridor (Southern Spine) in conjunction with the Sudbury Aqueduct and Chestnut Hill Pump Station do provide partial backup for the Dorchester Tunnel. Critical isolation valves cannot currently be exercised to keep them in good working order. The many tunnel appurtenances which connect the tunnel shafts to the surface piping are now 30 to 40 years old and will become more prone to malfunction with increasing age. Failures of critical appurtenances could necessitate a tunnel shut down with a possible disruption of water service over a wide area.

Although the Chestnut Hill Connecting Mains, the Shaft 7 to WASM 3 pipeline project, the rehabilitation of the Southern Spine mains, and the rehabilitation of WASM 4 will provide partial redundancy, the Metropolitan Tunnel Loop may beultimately necessary to create total redundancy for the City Tunnel, the City Tunnel Extension, the Dorchester Tunnel, and WASM 3. In addition, the northern portion of the tunnel loop could reduce pumping costs to the Fells Reservoir and the Northern Extra High and Intermediate High areas. With this portion of the tunnel loop in operation, WASM 3 could function as a distribution main, carrying water from the tunnel to the community meters and MWRA pumping stations. A new pumping station on the southern portion of the loop would provide improved service to the Southern Extra High Service Area.

Scope

Subphase	Scope
Feasibility Study/Survey	Examine the need for a Metropolitan Tunnel Loop, evaluate the practicality of construction of the tunnel in phases to improve system reliability incrementally, and identify alternatives for tunnel alignment and shaft location. Identify major environmental concerns and perform geological assessment of possible tunnel routes.

Chicopee Valley Aqueduct Interconnections (615)

Purpose

To provide backup service connections for the three communities served by the Chicopee Valley Aqueduct (CVA) in case of a CVA failure or shutdown. Interconnections will be made to the water distribution systems of Springfield and Holyoke to facilitate emergency water transfers to Chicopee, Wilbraham, and South Hadley Fire District No. 1.

Project History and Background

The CVA supplies water to Chicopee, Wilbraham, and South Hadley Fire District No. 1. The 48-inch and 36-inch diameter aqueduct was built in 1949 of reinforced concrete pipe with an embedded steel cylinder. It is the only means of supplying these communities with water. The capacity of the aqueduct is 23 million gallons per day, which is just sufficient to supply the communities' peak summer demand. It is currently not possible to perform routine maintenance without disrupting supply to these communities. Furthermore, should a breakdown occur, there is no other means of supplying these communities with water. Computer modeling indicates that if supply through the CVA is shut off up stream of Nash Hill, Chicopee would be without water after two days, and South Hadley and Wilbraham would be without water even sooner. If the CVA were shut off downstream of Nash Hill Reservoir, Chicopee would have no supply whatsoever. The long term solution may be a second barrel of the CVA. This project is an interim measure to increase reliability. The City of Chicopee has requested MWRA to evaluate construction of the most important 12 percent of the second barrel - the length from Nash Hill Reservoir to the Chicopee City line.

Scope

Subphase	Scope
Design/CA/RI	Design, construction administration, and resident inspection of four interconnections to water distribution systems in non-MWRA communities. This design will facilitate transfer of up to 12 mgd to the three contract communities.
Construction	Construction of the four interconnections. The first consists of 6,000 feet of 16-inch diameter water main, meter, and appurtenances to connect Holyoke to South Hadley Fire District No. 1. The second interconnection consists of 6,500 linear feet of 20-inch diameter main from Springfield to Chicopee and construction of a 4.5 mgd pumping station. The third interconnection consists of replacement of valves on an existing water main between Springfield and Wilbraham. A small pumping station consisting of one 40 horse power motor pump would also be constructed to operate during a few evening hours of extreme peak demand. The fourth interconnection consists of a small pumping station allowing treated water to be transferred from Springfield's Ludlow Reservoir into the Chicopee Valley Aqueduct in an emergency.

Winsor Dam Hydroelectric (597)

Purpose

To replace switchgear and to replace/rehabilitate the turbine generator at the Winsor Dam in Belchertown to allow the dam to produce hydroelectric power to be used to either supply the needs of MWRA and MDC buildings, including the proposed planned interim disinfection facility for the Quabbin Reservoir, or to sell to the electric grid, or to potentially wheel to other MWRA facilities.

Project History and Background

Currently, hydroelectric power facilities at Winsor Dam are inoperative and unlicensed. If practical, the facilities will be rehabilitated and licensed to generate power a potential source of revenue. Winsor Dam is in Belchertown and impounds the Quabbin Reservoir. At the dam, an intake feeds two conduits which are interconnected at a powerhouse below the dam. One conduit feeds the currently inoperative turbine/generator unit; the other conduit discharges to the Chicopee Valley Aqueduct. Bypass valves allow flow to be discharged directly to the Swift River. MWRA is required to release into the Swift River to satisfy minimum daily flow requirements established by regulation.

From 1946 to 1991, hydroelectric power was generated at the site, but in 1991 a fire destroyed the electrical switchgear and rendered the power generation equipment inoperative. Hydropower facilities must be licensed by the Federal Energy Regulatory Commission (FERC). Before the fire, MWRA had made initial efforts to procure necessary permits. The effort was discontinued after the fire. In 1995, the FERC regulatory process was resumed and a preliminary permit was issued to MWRA. The preliminary permit secured MWRA a priority position to file a license for hydropower development. MWRA filed the application in response to a competing preliminary permit to another entity. The terms of the preliminary permit issued required MWRA to conduct environmental and engineering studies to assess the project's feasibility.

Resuming hydropower generations at Winsor, will entail more than just replacing the switchgear and controls destroyed by the fire. In 1990, the mechanical and electrical systems were inspected and it was determined that the turbine runner needed replacement because of cavitation at low flows. The existing turbine, when in operation, rarely delivered its rated output and this resulted in low efficiencies. In addition, prior modes of operation are no longer permitable under current FERC licensing procedures and installation of a new unit may be necessary. A 24-hour continuous release from the powerhouse will now be required, which is a departure from the previous mode of operation. The selection of equipment and operating parameters will entail a thorough evaluation of water supply requirements, flow and discharges, and turbine/generator applications. While it may be necessary to purchase new units, rather than just rehabilitation of the existing units, no significant civil work is anticipated.

Scope

Subphase	Scope
Preliminary Permit Studies	Study to determine project feasibility.
Licensing & Detail Design	Licensing and detail design for hydropower at the Winsor Dam. Work will include replacing switchgear and controls, and turbines.

DISTRIBUTION AND PUMPING

PIPELINE REHABILITATION PROGRAM
GENERAL INFORMATION AND OVERVIEW

An overview of this program and general information about pipeline rehabilitation needs and methods are provided here as a common preface to the specific information presented in each of the project descriptions.

To assure reliable service, distribution pipelines should be strong and durable, have clean and smooth interiors, and be large enough to pass desired flows without excessive loss of head (pressure). Key factors which typically relate to these characteristics include age, pipe material, and the coefficient of friction (commonly expressed as the C-value). Typically, clean pipes with smooth linings have C-values near 140, while pipes in poorer condition have C-values between 40 and 100.

As pipes age, the effects of stress and deterioration can lead to more frequent leaks, breaks, and malfunctions of valves and other appurtenances. Pipe material composition is a factor because metal pipes lacking interior lining are particularly prone to problems such as excessive corrosion, pitting, and build up of tubercles. The presence of tuberculation is a water quality concern because bacteria can thrive among the tubercles and subsequently be released into the water. Taste, odor, and "rusty water" problems may also result from the build up of deposits. In addition, such deposits reduce the carrying capacity of a pipeline and cause friction and turbulence in the flow.

As a result of three decades of deferred maintenance and inadequate capital investment, the metropolitan distribution piping network requires rehabilitation and replacement. Presently, the median age of MWRA pipelines is 80 years, and 20 percent of the water mains are more than 100 years old. Approximately 75 percent of the system's 265 miles of pipeline are unlined.

Pipeline rehabilitation and renewal involves three basic approaches. If the pipeline is structurally sound, the preferred, lowest-cost method of rehabilitation is **cleaning and lining.** This approach entails thorough cleaning of the pipe to remove all internal deposits and installation of a cement-mortar lining. Usually, valves and appurtenances are replaced during this process.

Another rehabilitation method which reuses the existing pipe is called **sliplining.** This method involves the insertion of a new smaller diameter pipe within the existing main. Sliplining is used in limited instances where the resultant reduction in pipe capacity would not affect system performance.

The third approach to pipeline rehabilitation is conventional **pipe replacement.** This is the most costly form of rehabilitation, but is necessary when existing pipe conditions are so poor that removal of the old pipe and replacement with new pipe is the only worthwhile option.

Valve Replacement (677)

Purpose

To retrofit approximately 500 blow-off valves and replace several hundred main line valves within the pipeline distribution system. Blow-off valves retrofits will eliminate cross-connections into sewers or drainage piping. Main line valve replacements will improve MWRA's response to emergency situations such as pipe breaks and provide tight shutdown for pipeline construction projects. Faster responses will reduce negative impacts on customers. Combining the two valve replacement efforts will reduce repeat construction at each site and alleviate traffic impacts, repaving needs, and other site specific issues.

Project History and Background

MWRA owns and operates 265 miles of distribution pipeline which contain approximately 500 inoperable and inadequate blow-off valves and several hundred main line valves requiring repair or replacement. This project is in part a response to the Massachusetts DEP mandate to eliminate all cross-connections in the distribution systems. Currently, blow-off valves are cross-connected into sewers or drainage piping. To ensure that there is no chance of contamination, DEP requires that the blow-off valves be replaced to provide air gaps which ensure that non-potable water cannot reach the level of the blow-off outlet.

Failure of a blow-off valve also results in leakage and loss of water, which occurs in a small percentage of the current valves. Both the blow-off valve retrofits and main line valve replacements will permit maintenance and pipeline repairs to be performed more efficiently.

In-house crews are used for valve replacement every year, and are scheduled to replace an estimated ten blow-off valve and 20 main line valves per year. Contractors are used every other year to replace an estimated ten blow-off valves and ten main line valves.

Scope

Subphase	Scope
Design/Phase 1	Design approach is to prioritize valve replacement depending on the level of urgency or risk associated with each valve, and to schedule work on those valves that will not otherwise be replaced during upcoming pipeline rehabilitation projects.
Construction - Phase 1	Construction of 27 blow-off valve retrofits.

Construction - Phase 2	Construction of approximately 10 blow-off valve retrofits and 10 main line valve replacements.
Construction - Phase 3	Construction of approximately 30 blow-off valve retrofits and 30 main line valve replacements.
Construction - Phase 4	Construction of approximately 30 blow-off valve retrofits and 30 main line valve replacements.
Construction - Phase 5	Construction of approximately 30 blow-off valve retrofits and 30 main line valve replacements.
Equipment Purchase 2 - 11	Purchase of approximately 20 main line valves per phase for ten phases for replacement work to be done by in-house staff. Also includes the cost of line stops associated with this work.
Line Stops FY96	Cost associated with line stops needed for the replacement of main line valves by in-house crews
Technical Assistance	Technical assistance in the design and construction of valves.

Cathodic Protection of Distribution Mains (712)

Purpose

To evaluate the condition of approximately 60 miles of steel pipelines and determine the feasibility of upgrading or installing cathodic protection systems to protect pipelines from corrosion.

Project History and Background

Approximately 60 miles of MWRA waterworks pipelines ranging from 24 inches to 60 inches in diameter are made of steel and are particularly subject to corrosion from acidic soils, fluctuating groundwater levels (especially where the groundwater is saline), and stray electrical currents. These steel pipelines are located within 26 of MWRA's 46 water communities.

Cathodic protection reduces deterioration of steel pipelines, thereby increasing pipeline life and deferring the need for complete replacement. Without proper cathodic protection, pipeline leaks and failures increase, causing costly damage to abutters' property and possible loss of service to customers.

Some sections of the existing steel pipes were originally equipped with cathodic protection systems intended to reduce the effects of corrosion. Other steel pipelines had cathodic protection systems installed sometime after the original pipe installation. Still other sections of steel pipeline never received cathodic protection. Proper maintenance requires anode replacement every 15 years. Unfortunately, even existing cathodic protection systems were not maintained, and these systems are now no longer functioning.

Scope

Subphase	Scope
Planning Phase 1	Evaluate the condition of the steel pipelines. Identify areas of rapid corrosion due to stray currents. Design and install new sacrificial anodes. Restore existing impressed current systems to operation.
Planning Phase 2	Determine the amount of restoration and installation of cathodic protection required.
Construction 1 to 5	The Construction subphase consist of the installations of approximately at approximately 400 foot intervals. The contract will use vacuum excavation to expose a small section of pipe where wires will be attached to the pipe and a reference anode to collect test data. Upon completion of the five construction contracts, planning and engineering staff will prioritize and determine the scope of rehabilitation work for the pipelines.

Boston Low Service Pipe and Valve Rehabilitation (678)

Purpose

To improve the condition and operability of the pipelines comprising the Boston Low Service System. These unlined, cast iron pipelines are more than 120 years old. The mains have numerous non-functional valves, and have experienced frequent breaks. Improvements will include some pipe replacement, cleaning and lining, and selective abandonment of unneeded segments.

Project History and Background

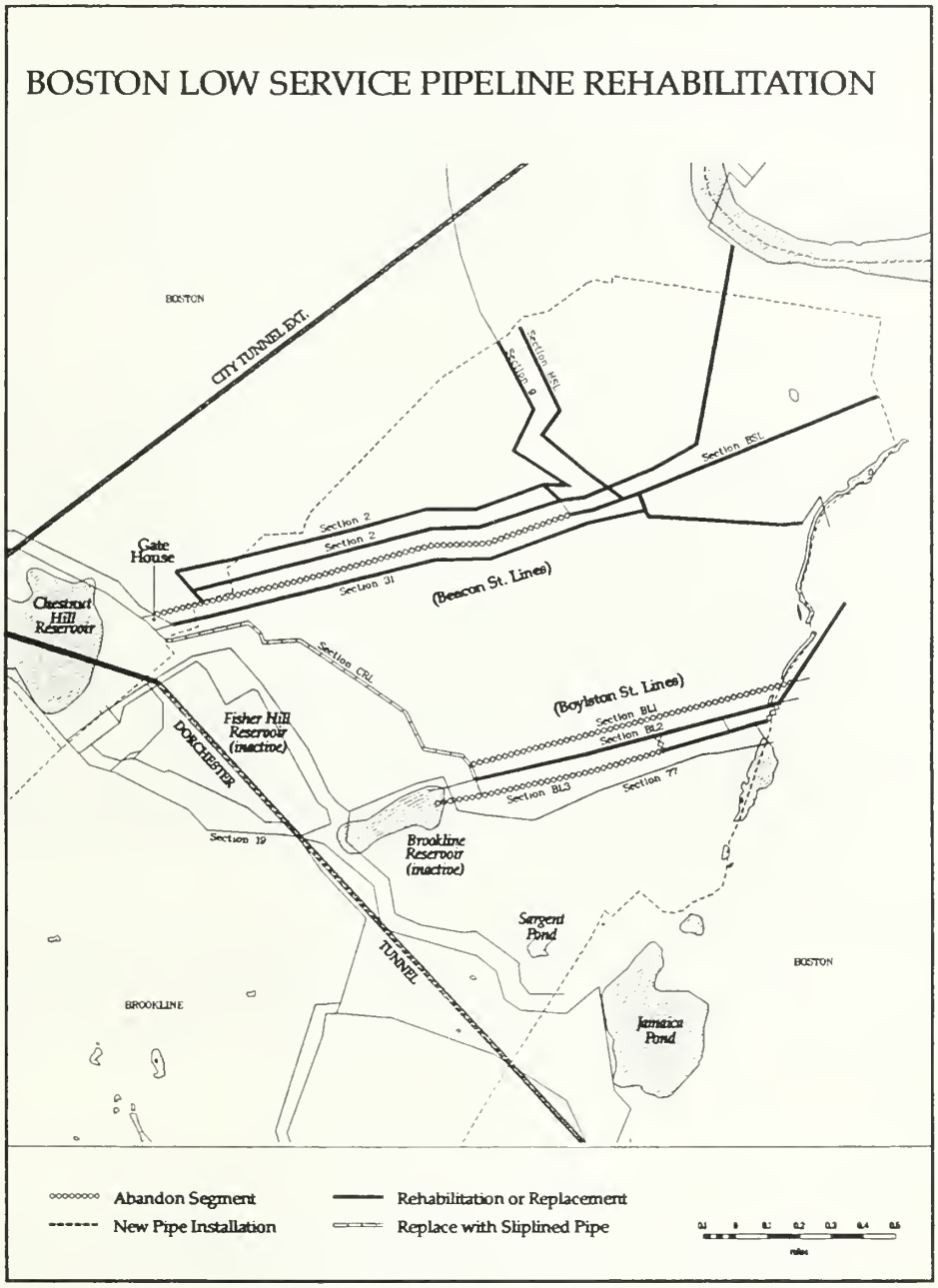
The Boston Low Service network serves downtown Boston and surrounding areas. Water delivered by this network accounts for 15 percent of MWRA use. The Boston Low Service System contains more than 20 miles of old 36- to 48- inch diameter cast iron pipe. The pipes were laid in the 1800s before the advent of heavy vehicles. The pipes are subject to a disproportionate share of major breaks due both to their age and surface loadings in excess of design strength. Pipe breaks result in service disruptions, loss of water, property damage, and even collapse of street pavement. During a pipe repair, the broken section is isolated by closing valves on either side of the break for the purpose of shutting off the water and preventing major water loss. More than 40 percent of the isolation valves on these pipelines are not operational; and not repairable because of their age. Their condition inhibits the ability to shut down the lines quickly during an emergency.

Rehabilitation of the pipeline and replacement of the valves will improve service reliability, reduce the risk of property damage, and improve water conservation by reducing leakage.

Scope

Subphase	Scope
Study - Pipe	Determined the structural integrity of the pipe, the condition of the bedding material, and the extent of pipe corrosion. The study revealed that approximately 10.6 miles of pipeline required either cleaning and cement-mortar lining with internal seals installed at pipe joints or other rehabilitation. Three pipelines with a total length of 3.7 miles will be filled with a sand cement slurry and abandoned.
Test Pits	Exploratory excavations completed in Brookline to expose cast-iron pipes at ten sites considered representative of conditions in the overall Boston Low Service System. This was completed in-house.
Phase 1 - Equipment Prepurchase	Equipment purchases for the replacement of valves and other appurtenances near the Chestnut Hill Reservoir Gate House.

Design/CS - Clinton Rd..& Boylston St.	Design and construction services for the rehabilitation and/or abandonment of Clinton Rd. and Boylston St. lines.
Construction - Clinton Rd..& Boylston St.	Sliplining of the Clinton Rd. line and the rehabilitation and/or abandonment of Boylston St. lines.
Design/CS - Beacon St.	Design and construction services of the rehabilitation and/or abandonment of the Beacon St. lines, the Beacon/Longwood line, the Harvard St. line, and sections of the East and West Spot Pond Supply Mains in Brookline.
Construction - Beacon St.	Rehabilitation and/or abandonment of the Beacon St. lines, the Beacon/Longwood line, the Harvard St. line, and sections of the East and West Spot Pond Supply Mains in Brookline.
Resident Inspection	Resident inspection for construction of Clinton Rd., Boylston St., and Beacon St.


BOSTON LOW SERVICE PIPELINE REHABILITATION
BOSTON
CITY TUNNEL EXT.
Section HSL
Section 9
Section BSL
Section 2
Section 2
Section 31
Gate House
(Beacon St. Lines)
Chestnut Hill Reservoir
Section CBL
(Boylston St. Lines)
Section BL1
Section BL2
Section BL3
Section 77
Fisher Hill Reservoir (inactive)
DORCHESTER
Section 19
Brookline Reservoir (inactive)
Sargent Pond
TUNNEL
BROOKLINE
BOSTON
Jamaica Pond
Abandon Segment
New Pipe Installation
Rehabilitation or Replacement
Replace with Sliplined Pipe
0.1 0 0.1 0.2 0.3 0.4 0.5
miles

Rehabilitation of Weston Aqueduct Supply Mains (WASM) 1 and 2 (718)

Purpose

To improve the condition and carrying capacity of these major supply lines serving the Boston Low System. WASM 1 and WASM 2 were built in 1904 and 1916, respectively. Both are unlined, cast-iron mains with poor internal conditions and many inoperable valves. Rehabilitation will address these deficiencies primarily through cleaning, lining, joint sealing, and valve replacement.

Project History and Background

WASM 1 is a 48-inch diameter unlined cast iron pipeline about 38,700 feet long. WASM 2 is a 60-inch diameter unlined cast iron pipeline about 34,800 feet long. WASMs 1 and 2 begin in Weston at the Weston Aqueduct Terminal Chamber (WATC) and run parallel through Newton, mostly along Commonwealth Avenue, ending in Boston near Chestnut Hill. These pipelines supply water to the Boston Low pressure zone. WASMs 1 and 2 are currently functioning below their full carrying capacity due to a build up of rust deposits and other matter along the pipeline walls, and undersized main line valves. Rehabilitation of these pipelines is necessary to restore their original carrying capacity and will include replacement of valves to provide more efficient operations and emergency response, elimination of tuberculation on the interior walls, application of cement mortar lining to the interior pipe wall to prevent further internal corrosion, and installation of rubber seals on the interior of each pipe joint to prevent leakage through the old lead packed joints. About 7,200 feet of each line has been included in the MetroWest Tunnel project under the Loring Road Tanks - CP8 contract and the WASM 4 contract.

Existing valves will be replaced and additional valves will be incorporated into the pipelines. With new valves, the ability to respond to emergencies requiring isolation or re-routing of flow will be greatly enhanced, thereby reducing the damage, cost, and risk associated with a pipeline break.

Scope

Subphase	Scope
Design/CA/RI	Exploratory excavation and corrosion analysis will evaluate the structural integrity of the pipes, the condition of the bedding material, and the extent of pipe corrosion. Design, Construction Administration, and Resident Inspection of approximately 31,500 linear feet of 48-inch pipeline and approximately 27,600 linear feet of 60-inch pipeline.
Easements	Easements along the construction route for construction contracts.

Construction - Commonwealth Ave. & Centre St. Newton Phase A	Rehabilitate approximately 13,700 linear feet of 48-inch pipeline of WASM 1 (SPL 2) and 12,500 linear feet of 60-inch pipeline of WASM 2 (SPL 5 & 6), from the Mass Pike to Bullough Parkway along Commonwealth Avenue in Newton and including a short segment along Centre St. from Colby to Sargent St. for WASM 1 (SPL3).
Construction - Newton and Brighton Phase B	Rehabilitate approximately 18,300 linear feet of 48-inch pipeline of WASM 1 (SPL 3 & 4). This includes work from Bullough Parkway to Centre St. and from Centre St. down Sargent St. across the golf course to the Brighton line and Commonwealth Avenue in Brighton. Rehabilitate approximately 9,500 linear feet of 60-inch pipeline and a segment of about 2400 linear feet of 80-inch diameter rock tunnel of WASM 2 (SPL 7). This includes work from Commonwealth Ave. along Grant Avenue across the golf course to the Brighton line and Commonwealth Ave. in Brighton.

Warren Cottage Line Rehabilitation (720)

Purpose

To improve the carrying capacity and internal condition of the Warren Cottage Line which serves a portion of Boston via the Southern High Service System. Improvements, which will also strengthen the surface connection between Shafts 7B and 7C of the Dorchester Tunnel, will include cleaning and lining to remove build up of rust deposits.

Project History and Background

The Warren Cottage Line is part of the Southern High Service System in Brookline and Boston. The 131 year old pipe is approximately 5,700 linear feet and extends from the Fisher Hill Reservoir in Brookline to Boston Meter 6. It has been estimated that the line has approximately 50 percent of its original carrying capacity (C-Value: 68) due to the build up of rust deposits and other matter along the pipeline walls.

Scope

Subphase	Scope
Design	Exploratory excavation and corrosion analysis to evaluate the structural integrity of the pipe, the condition of the bedding material, and the extent of pipe corrosion. Design of the pipeline.
Easements	Acquisition of easements required for rehabilitation of the pipeline.
Construction	Rehabilitation of 5,700 linear feet of 30-inch unlined cast iron pipe primarily through cleaning and cement mortar lining and replacement of all gate valves, blow-off valves, and other appurtenances.

Southern Service Improvements (681)

Purpose

To improve the reliability and capability of key facilities serving the Southern High and Southern Extra High systems. These facilities include the Newton St. Pump Station, the Hyde Park Pump Station, their suction pipelines and their discharge pipelines which supply Brookline, Milton, Quincy, Canton, and part of Boston. Improvements will be made to the Newton St. Pump Station. Existing yard piping in both Newton St. and Hyde Park (Rehabilitation of Other Pump Station Project) will be replaced. New suction and discharge pipelines will be constructed for both pump stations.

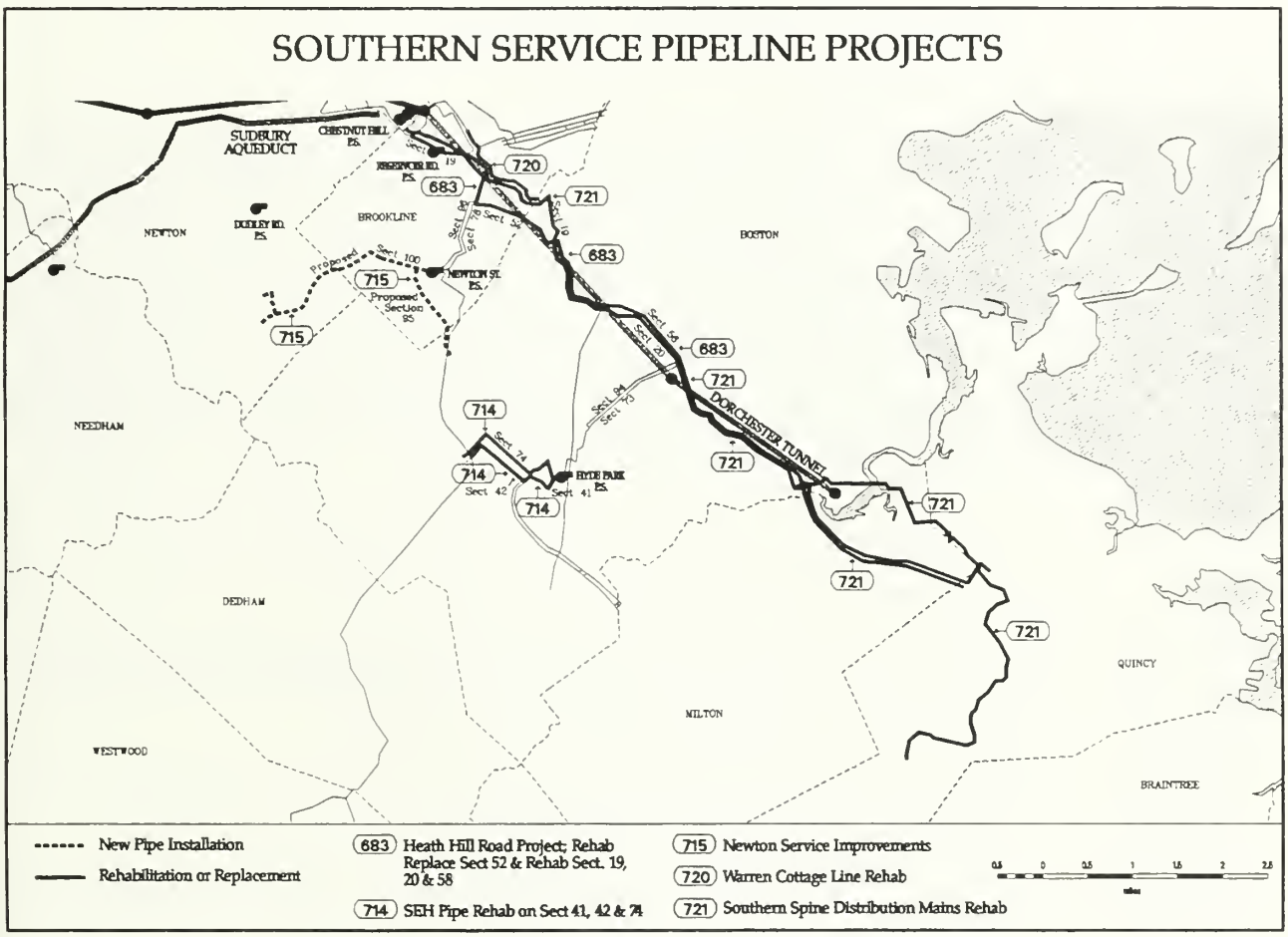
Project History and Background

The Southern High Service pipeline delivers water to the Hyde Park and Newton Street Pump Stations. The Hyde Park and Newton St. Pump Stations pump water into the Southern Extra High Service Pipelines which supply a service region that includes Brookline, Milton, Quincy, Norwood, much of Boston, and part of Canton. The Hyde Park Station was built in the 1890s. The Newton St. Pump Station was constructed in the 1950s. The pumps at the Newton St. Pump Station and the yard piping at both stations are inadequate to meet the current and future water supply needs of the service region. In addition, portions of the pipeline suffer from corrosion and lack the capacity and strength needed to ensure service delivery.

Scope

Subphase	Scope
Design Hyde Park Ave - Yard Pipe	Design of the replacement of yard piping at the Hyde Park Pump Station.
Design/CS/RI - Hyde Park Ave.	Design of the construction of 7,100 linear feet of new 36-inch pipe.
Construction -Hyde Park Pipeline	Construction of 7,100 linear feet of new 36-inch pipe.
Easements - Hyde Park Pipeline	Easements needed along the construction route.
Hyde Park Pipeline Permit/Rd. Restoration	City of Boston road opening permits and surface restoration deposit for approximately 60 vacuum excavations to locate existing utilities to facilitate the design of the pipeline.
Design/CS/RI - Newton St. Pump Station	Design, construction services, and resident inspection for major rehabilitation of the pump station including new pump units, redundant piping, isolation valves to prevent flooding, emergency generators, replacing building systems, and building and site refurbishment.

Construction - Newton St. Pump Station-Phase 1	Provide immediate upgrades of mechanical/electrical systems, and minor building improvements.
Construction - Newton St. Pump Station-Phase 2	Replace pumping units, electrical and mechanical systems, redundant piping, isolation valves, install an emergency generator, and complete building and site refurbishment.
Design/CS/RI - 94 & 96	Design 5,600 linear feet of 30- to 36-inch suction pipeline to the Newton St. Pump Station and 7,500 linear feet of 30-inch suction pipeline to the Hyde Park Pump Station.
Construction - Section 96	Construction of 5,600 linear feet of 30- to 36-inch suction pipe to the Newton St. Pump Station.
Construction - Section 94	Construction of 7,500 linear feet of 30-inch suction to the Hyde Park Pump Station.
Boston Paving	Final road restoration of 7,500 linear feet along American Legion Highway in Boston associated with Section 94 construction.
Boston Paving HP Pipeline:	The project was accelerated due to City of Boston plans to reconstruct Hyde Park Ave., starting in 1999.
Technical Assistance	Technical assistance for construction of the Newton St. Pump Station and adjoining pipelines.


SOUTHERN SERVICE PIPELINE PROJECTS
SUDBURY AQUEDUCT
CHESTNUT HILL PS.
KENMORE RD. PS.
DUDLEY RD. PS.
NEWTON
BROOKLINE
BOSTON
NEWTON ST. PS.
Proposed Section 95
NEEDHAM
HYDE PARK PS.
DORCHESTER TUNNEL
DEDHAM
MILTON
QUINCY
WESTWOOD
BRAINTREE
720
683
721
715
714
New Pipe Installation
Rehabilitation or Replacement
683 Heath Hill Road Project; Rehab Replace Sect 52 & Rehab Sect. 19, 20 & 58
714 SEH Pipe Rehab on Sect 41, 42 & 74
715 Newton Service Improvements
720 Warren Cottage Line Rehab
721 Southern Spine Distribution Mains Rehab

Heath Hill Road Pipe Replacement (683)

Purpose

To repair and improve pipelines and valves which are in poor condition in the Southern High and Southern Extra High Service areas. The targeted pipelines in Brookline and Boston have experienced numerous leaks and breaks, and their hydraulic performance is inadequate. Work will include a fast-track pipe replacement phase, and mostly cleaning and lining along the other pipe segments.

Project History and Background

These sections of pipeline near Heath Hill Road supply water to Brookline, Boston, and the Southern Extra High Service System. The severe corrosion on Sections 19, 20, 52, and 58 has resulted in 23 leaks during the last ten years. This project consists of the rehabilitation and/or replacement of these pipelines. Section 58 is 60 years old, and Sections 19 and 20 are 100 years old. All sections have extensive records of leaks and breaks and warrant rehabilitation or replacement. These 36- and 48-inch diameter cast iron and steel mains run parallel to the Dorchester Tunnel and serve as a suction main to the Hyde Park Pump Station which supplies the Southern Extra High System. The 54-inch steel main Section 52 extends from Chestnut Hill Pump Station to Sections 19, 20, and 58 and provides suction to the Newton St. Pump Station.

Scope

Subphase	Scope
Design/CS/RI-Section 52 Replacement	Design and related construction services for the replacement of 820 linear feet of pipe with new 54-inch diameter pipe and the installation of a new butterfly valve.
Construction 52 Replacement	Replacement of a portion of Section 52 and the installation of a new butterfly valve.
Design/CS/RI-Section 52 Rehabilitation	Design and related construction services for the removal and replacement of and valve connections along Section 52 and cement mortar lining of approximately 12,500 linear feet of 54-inch steel pipe.
Construction-Section 52 Rehabilitation	Rehabilitation of a portion of Section 52 steel pipe and replacement of valve connections.
Des/CS/RI-Sections 19, 20, & 58	Rehabilitation of approximately 11,000 feet of 48-inch diameter and 10,000 feet of 36-inch diameter segments of Sections 19, 20, and 58. Also includes valve, meter, and vault construction at Shaft 7C to incorporate all hazardous material work at Shaft 7C into one contract.
Legal/Easements-Rehabilitation	Easements along the construction route for Section 52 Rehabilitation.

Legal/Easements-New	Easements along the construction route for Section 52 - New.

Southern Spine Distribution Mains (721)

Purpose

To increase carrying capacity and improve valve operability along the large surface mains which run parallel to the Dorchester Tunnel in providing service to the Southern High and Southern Extra High systems. Currently these spine mains have serious hydraulic deficiencies and many inoperable valves. Hydraulic performance improvements are needed to provide redundancy for the Dorchester Tunnel. Work will include rehabilitation of more than 12 miles of large diameter pipeline.

Project History and Background

The Southern Spine Distribution Mains comprise the surface piping which parallels the Dorchester Tunnel. The mains begin in the vicinity of Shaft 7B in Brookline and end at the Blue Hills Reservoir in Quincy. The mains serve the Southern High and Southern Extra High System communities of Boston, Brookline, Milton, Quincy, Norwood, and Canton.

Because of the poor conditions of the valves, Waterworks Operations staff frequently have to close several valves in order to shut down the line. This practice often results in closing more of the system than is otherwise necessary. Several of these pipelines are currently functioning at approximately 50 percent of their original carrying capacity (C-Values: 60-70) due to the build up of rust deposits (tubercules) and other matter along the pipeline walls. In their present condition, these mains could not provide adequate service to users if the Dorchester Tunnel was taken off-line.

Scope

Subphase	Scope
Phase 1 Design/CS/RI Sections 21, 22 & 43	Exploratory excavation and corrosion analysis performed during the preliminary design phase will evaluate the structural integrity of the pipe, the conditions of the bedding material, and the extent of pipe corrosion. Design, construction services, and resident inspection for the rehabilitation of 30,000 linear feet of 48-inch main and 24,500 linear feet of 24-inch main.
Easements-Sections 21, 22 & 43	Acquisition of property and/or easements required to complete sections 21, 22, & 43.
Construction - Sections 21, 22 & 43	Rehabilitation of 30,000 linear feet of 48-inch main, and 24,500 linear feet of 24-inch main. Rehabilitation is expected to consist of cleaning and cement mortar lining the interior pipeline wall, as well as replacing all the main line valves, blow-off valves, and appurtenances.
Phase 2 Design/CS/RI Section 19	Design, construction services, and resident inspection for the rehabilitation of 13,400 linear feet of 48-inch main.

Easements - Section 19	Acquisition of property and/or easements required to complete Section 19 work.
Construction - Section 19	Rehabilitation of 13,400 linear feet of 48-inch main. Rehabilitation is expected to consist of cleaning and cement mortar lining of the interior pipeline wall, as well as replacing all the main line valves, blow-off valves, and appurtenances.
Phase 3 Design/CS/RI Section 20 & 58	Design, construction services, and resident inspection for the rehabilitation of 21,000 linear feet of 36-inch main.
Easements - Section 20 & 58	Acquisition of property and/or easements required to complete sections 20 & 58 work.
Construction - Section 20 & 58	Rehabilitation of 21,000 linear feet of 36-inch main. Rehabilitation is expected to consist of cleaning and cement mortar lining the interior pipeline wall, as well as replacing all the main line valves, blow-off valves, and appurtenances.
Adams Street Bridge	Relocation of a pipeline made necessary by the reconstruction of this bridge by the MBTA.

Southern Extra High - Sections 41, 42, and 74 (714)

Purpose

To increase the hydraulic carrying capacity of the mains that carry pumped water to the Bellevue Tanks, which serve the Southern Extra High System. Because Sections 41, 42 (80-year old cast iron mains), and 74 (45-year old prestressed concrete cylinder pipe) are severely limited in the pressures and flows they can convey, the Hyde Park Pump Station cannot operate efficiently. Improvements will include pipeline replacement and rehabilitation.

Project History and Background

Sections 41 and 42 were built in 1914 of unlined, cast-iron 20-inch pipe. Section 74 was built in 1951 of prestressed concrete cylinder pipe. These mains connect the Hyde Park Pump Station and the Newton St. Pump Station discharge pipeline (Section 77) to Bellevue Tanks 1 and 2. These pipe sections pass through the Hyde Park section of Boston and serve Norwood, Canton, Brookline, Milton, and Boston. They were installed prior to the construction of Bellevue Tank 2, and which stands 25 feet higher than Bellevue Tank 1. Section 41 and 42, and portions of Section 74, were not designed for the increased pressure caused by the higher height of Bellevue Tank 2. As a result, the Hyde Park Pump Station is never operated at full capacity unless the Tank 2 water level is extremely low. Because the Southern Extra High Service System has limited storage capacity, it is undesirable to have Tank 2 at a low level. Therefore, the pump station operates below capacity despite the fact that pressure in the system is barely sufficient to meet peak demand.

Because of the higher pressures when Bellevue Tank 2 came on line, these pipes are susceptible to breaks. Approximately 10,600 feet of Sections 41, 42, and 74 will be replaced and approximately 5,700 feet of Section 74 will be rehabilitated with new valves and appurtenances.

Scope

Subphase	Scope
Design/CS/RI	Design, construction services, and resident inspection for replacement of Sections 41, 42, & 74.
Easements	Easements along the construction route.
Construction	Replacement of Sections 41 & 42 with 8,000 feet of new 24-inch diameter main, and a portion of Section 74 with about 2,700 feet of new 24-inch diameter pipe. Rehabilitation of 6,400 feet of 20-inch diameter main of Section 74.

Chestnut Hill Connecting Mains (719)

Purpose

To simplify the complex arrangement of old pipes near Chestnut Hill for safety and operability, and to create a connection between Shaft 7 of the City Tunnel and the Southern Distribution surface mains for redundancy along the Dorchester Tunnel. Restructuring of the piping arrangement will be achieved by a combination of constructing new pipelines, rehabilitating older pipelines, sliplining abandoned aqueducts, replacing pressure regulating valves, replacement of the emergency pumps at Chestnut Hill, and abandoning pipes and valves which are no longer needed for service.

Project History and Background

At Chestnut Hill the City Tunnel divides into two branches: the City Tunnel Extension going north to supply the Northern High System and the Northern Intermediate High System, and the Dorchester Tunnel which goes south to supply the Southern High System and the Southern Extra High System.

There are two shafts in this area: Shaft 7 on the City Tunnel, which is located immediately west of the Chestnut Hill Reservoir, and Shaft 7B on the Dorchester Tunnel, located immediately east of the reservoir. At each of these shafts, two newer pipes extend to connect to the older pipelines of the Boston and Northern Low Service Systems and the Southern High Service System to supply these systems with water from the tunnel.

The Southern High System can only be supplied from Shaft 7B. If the Dorchester Tunnel were to be out of service, it would be necessary to activate the Sudbury Reservoir System, transmit water from there via the Sudbury Aqueduct (currently on standby) to the Chestnut Hill Reservoir (currently on standby) and utilize pumps in the existing High and Low Service Pumping Stations at Chestnut Hill to pump water from the reservoir to the Southern High System. This water would not be of acceptable quality and would require a boil order.

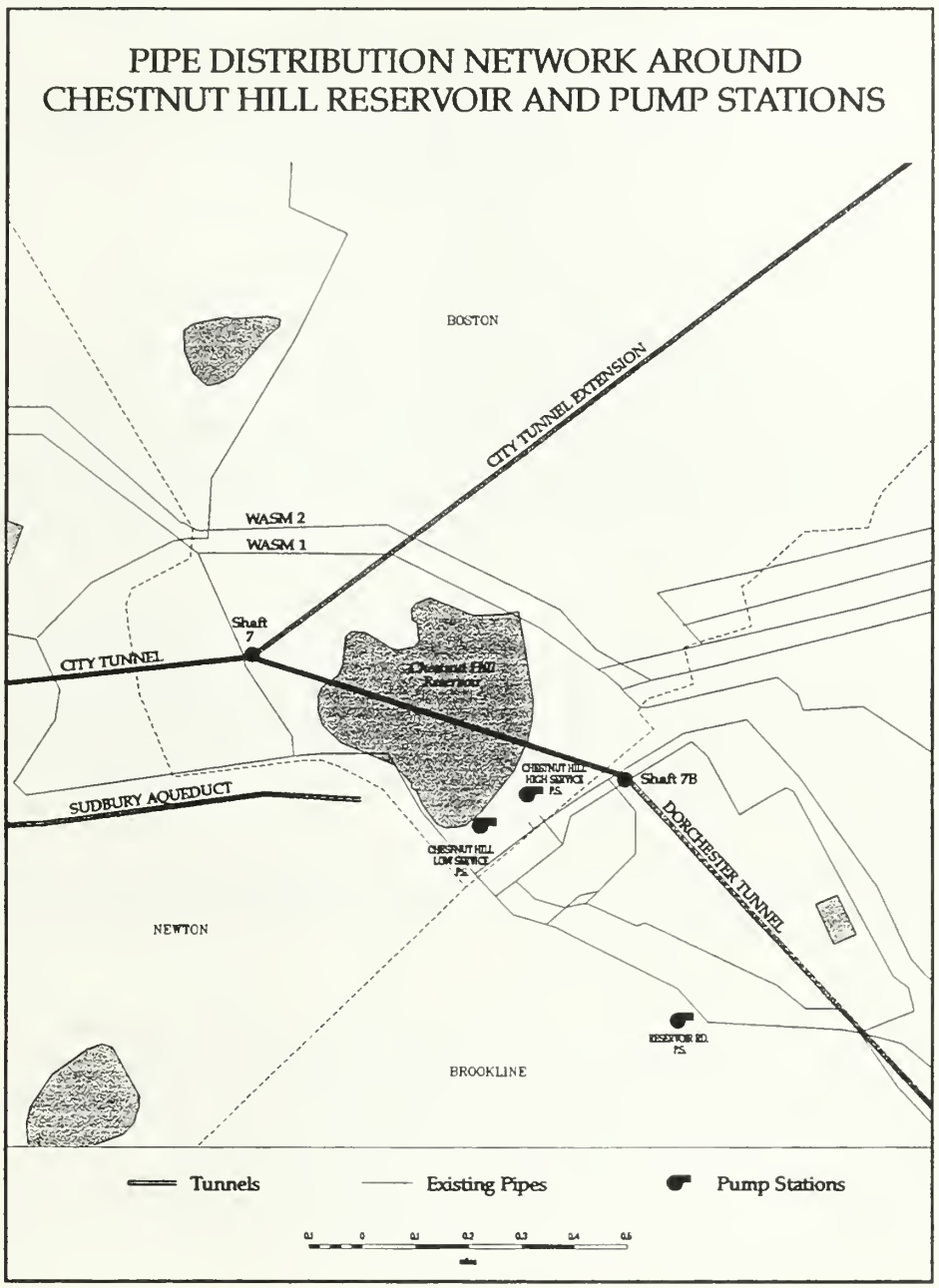
The older pipes in the area were originally designed to be supplied from the Cochituate and Sudbury Aqueducts, the Chestnut Hill Reservoir, or the Chestnut Hill High Service and Low Service Pump Stations. None of these facilities are presently in normal use. The pipe network is not only old and inordinately complex, but it is not designed to take water from the two tunnel shafts which are the present source of supply. Portions of this pipe network will be rehabilitated and integrated into the present operation of the system. Considerable lengths of pipe with minimal or stagnant flow, which are a source of red water, will be abandoned. Some new pipe will be added to better interconnect the two tunnel shafts with the surface pipe network.

The High and Low Service Pumping Stations serve no other purpose than to house the emergency pumps. Construction of a new underground pumping station with new pumping equipment will allow

these structures to be removed from active surface, and eliminate their associated high maintenance costs. It will also improve system reliability by providing assurance that the pumping capability will be available when needed in the event of an emergency.

Scope

Subphase	Scope
Routing Study	Based on conditions of existing pipe, technical and financial analysis of several options will result in the selection of the least cost, technically feasible alternative which meets the objectives of the project. (Scope excludes emergency pump facility rehabilitation/relocation alternatives.)
Design/CA/RI-Pipe Connection	Design, construction administration, and resident inspection for the rehabilitation of 1,980 linear feet of 48-inch pipe, 2,400 linear feet of 36-inch pipe, and two Fisher Hill pipelines: one that is 1,150 linear feet of 30-inch pipeline, and one which includes 2,000 linear feet of 36-inch pipeline, installation of 1,160 linear feet of 36-inch pipeline, sliplining 9,000 linear feet of the Cochituate Aqueduct.
Design/CA/RI Emergency Pump Relocation	Design/CA/RI services for relocation of the emergency pumping function and other minor facilities from the existing high and low service pump station building to a new underground building to be constructed adjacent to the high service building. The relocation will permit these historic buildings to be surplused by MWRA and converted to other uses. The new pump station will have the capacity to pump 90 MGD from the Sudbury Aqueduct/Chestnut Hill Reservoir to the Southern High Distribution System.
Design/CA/RI Emergency Pipe Connections	The Design/CA/RI of the piping necessary for both suction and discharge to eliminate potential cross-connections between potable and non-potable water. It will generally reconfigure the complex piping layout at Chestnut Hill to work well with the system as it now exists.
Construction - Emergency Pump Relocation	The construction of a new 90 MGD pump station to pump water from the Sudbury Aqueduct/Chestnut Hill Reservoir to the Southern High Distribution System
Construction - Emergency Pipe Connections	Construction piping necessary for both the suction and discharge to the new pump station.
Easements	Easements along the construction route.



Pipe Distribution Network Around Chestnut Hill Reservoir and Pump Station

Newton Service Improvements (715)

Purpose

To provide a new means of supply to Newton's Oak Hill Tank so that the antiquated Dudley Road Pump Station can be abandoned. This new pipeline will also provide redundancy in case of a breakdown at the Commonwealth Avenue Pump Station.

Project History and Background

With a population of 82,585, Newton is MWRA's second largest water customer. Approximately 85 percent of the water delivered to Newton is pumped from the Commonwealth Avenue Pump Station, which connects to the City Tunnel through a single connection at Shaft 6. Although the Commonwealth Avenue Pump Station Rehabilitation Project will provide redundant pumping and power capacity, the single connection to the City Tunnel has proven to be inadequate. In 1990, a valve failed on the pipeline which connects Shaft 6 to the pump station, disrupting water supply to Newton for half of a day.

The Oak Hill section of Newton is presently served by the Dudley Road Pump Station. The station is antiquated, and while the flows and pressures to the service area are adequate under average flow conditions, the station is unable to meet the fire flow service goal for the area. Rather than rehabilitate this station, MWRA plans to serve the Oak Hill area with a new pipeline connected to the Newton Street Pump Station in Brookline.

Because the suction pipes for the Newton Street Pump Station connect directly to the Dorchester Tunnel, this project will improve reliability and redundancy for both the connection to the City Tunnel and the pump station.

A possible future phase would involve installation of 5,700 linear feet of new 24-inch diameter pipeline connecting from Section 75 to Section 24 at Mamet Road in Newton. The new connection, together with rehabilitation improvements described in the New Connecting Mains-Shaft 7 to WASM 3, would unify the Intermediate High service zones in Arlington and Newton. Hydraulic performance would be improved and reliability would be enhanced. Discussions are planned to incorporate the Newton Covered Reservoir into this future scenario. No funds are budgeted for this future phase.

Scope

Subphase	Scope
Design/CS/RI Sections 95 & 100	Design of a new pipeline connected to the Newton St. Pump Station in Brookline to serve the Oak Hill area in Newton.
Easement	Acquisition of property required to complete the project.
Construction Sections 95 & 100	Installation of 11,278 linear feet of new 24-inch pipeline (Section 100) west from Brookline to the Oak Hill service area in Newton. In addition, 7,350 linear feet of new 30-inch diameter pipeline (Section 95) will be installed, which will run parallel to Section 78. Also, meter # 157 will be rehabilitated. Section 95 has been re-routed to avoid poor soil conditions, and combined with the Oak Hill project under a single construction contract.
Technical Assistance	Technical assistance for the design and construction of the pipeline.
Tree Replacement	Removal of a tree which is in conflict with the proposed suction main.

Commonwealth Avenue Pump Station Modernization (684)

Purpose

To modernize and improve this 45-year old station which serves a major portion of Newton. The station presently is undersized, has obsolete pumps and motors, and is susceptible to power failures. Improvements will include building upgrades, a new diesel generator, larger pumps and motors, and installation of telemetry.

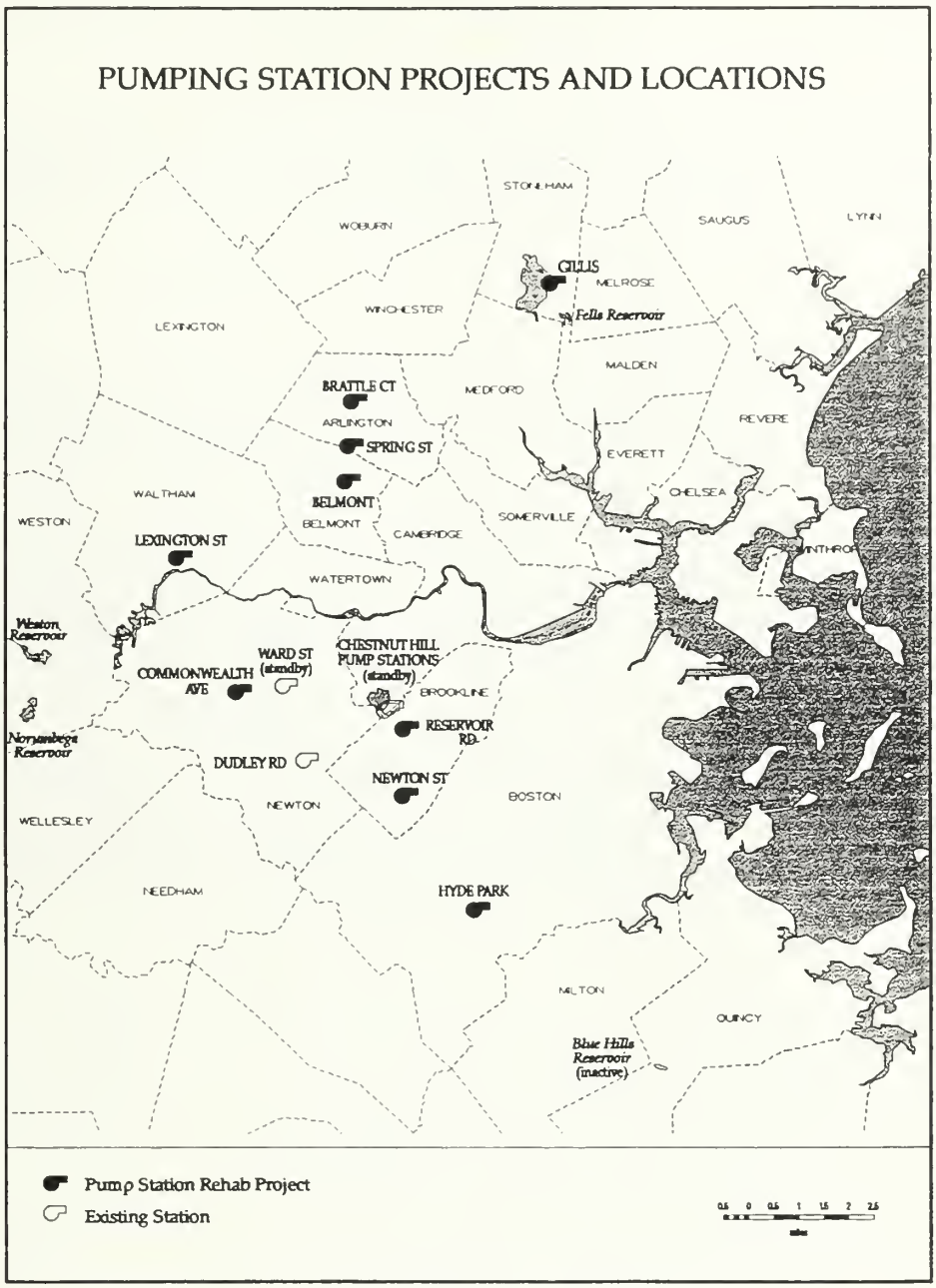
Project History and Background

The Commonwealth Avenue Pump Station is a 45-year old facility serving Newton. The station's three electric pumps and motors are undersized and nearing the end of their useful lives. The facility is also susceptible to power failure which can result in interruptions in service. Modernization of the pump station will provide the City of Newton with reliable water service delivery.

The major elements of this project include improvements within the existing station and construction of an adjacent building to increase pumping capacity and reliability.

Scope

Subphase	Scope
Preliminary Design	Design of the pump station improvements and of the construction of an adjacent building which will include a new diesel generator and four new ten mgd pumps and electric motors to increase pumping capacity.
Design/CS/RI	Final design of the improvements to the pump station and construction services and resident inspection.
Appraisal	Appraisal of the land necessary for acquisition to complete the project.
Land	Acquisition of land required to complete the project.
DEP Fees	Fees to the Department of Environmental Protection.
PCB Abatement	PCB remediation prior to construction.
Construction Phase 1	Immediate system upgrades to the pump station.
Construction Phase 2	Rehabilitation of existing station includes installation of two pumps and electric motors, as well as new piping and controls. Modernization will also consist of the addition of monitoring equipment, ventilation, and a security system. The new building adjacent to the existing pump station will include a new diesel generator and two new ten mgd pumps and electric motors.
Technical Assistance	Technical assistance for the design and construction of the pump station.


PUMPING STATION PROJECTS AND LOCATIONS
STONEHAM
WOBURN
SAUGUS
LYNN
GILLIS
MELROSE
WINCHESTER
Fells Reservoir
LEXINGTON
MALDEN
BRATTLE CT
MEDFORD
ARLINGTON
REVERE
SPRING ST
EVERETT
WALTHAM
BELMONT
CHELSEA
WESTON
BELMONT
SOMERVILLE
CAMBRIDGE
LEXINGTON ST
WINTHROP
WATERTOWN
Weston Reservoir
WARD ST (standby)
CHESTNUT HILL PUMP STATIONS (standby)
COMMONWEALTH AVE
BROOKLINE
RESERVOIR RD.
Norumbega Reservoir
DUDLEY RD
NEWTON ST
NEWTON
BOSTON
WELLESLEY
NEEDHAM
HYDE PARK
MILTON
QUINCY
Blue Hills Reservoir (inactive)
Pump Station Rehab Project
Existing Station
0.5 0 0.5 1 1.5 2 2.5
miles

Lexington Street Pump Station Rehabilitation (687)

Purpose

To modernize and improve this 48-year old pump station in Waltham which serves the Northern Extra High System. The station's pumping capacity is inadequate to meet water demands which creates inefficiencies and places stress on other facilities. Improvements will include larger capacity pumping units, backup power generation, and various electrical upgrades.

Project History and Background

The Lexington Street Pump Station provides water to the Stearns Hill section of Waltham. The station has a capacity of 2.7 million gallons per day. The average demand of the service area is about 4 mgd, with peak demand of 6.5 mgd. Future demand is projected to be 5 mgd on average and 8 mgd at peak periods by the year 2020. The present 1.3 mgd average day deficiency is met by a connection to the Northern Extra High Service System. Water must travel from Waltham to a pump station in Arlington in order to be pumped to an elevated tank in Lexington, from which it then flows by gravity to a connection in Waltham. It will be more efficient to simply pump the water at Lexington St. in Waltham.

To meet current and projected demand, the pumping units at Lexington St. will be replaced with two new 5 mgd pumps, and one new 8.5 mgd pump. Related electrical gear and appurtenances will be installed. To provide facilities for automatic start-up in case of power failure, a generator will be installed. Construction will also include 1,750 linear feet of piping to provide redundant suction and discharge mains for the new pumping units, and isolation valves to protect the station from flooding.

Scope

Subphase	Scope
Design/CS/RI	Design, construction services, and resident inspection for the rehabilitation of the pump station.
Land	Acquisition of the land required to complete the project.
Construction Phase 1	Replacement of substandard and defective wiring, electrical equipment, and underground storage tanks to provide safety improvements.
Construction MDPW	Installation of 1,250 feet of a suction main as part of a Massachusetts Department of Public Works urban system project.
Construction Phase 2	Replacement of the pumping units with two new five mgd pumps, and one 8.5 mgd pump, electrical and mechanical systems; installation of an emergency generator; completion of building and site refurbishing; installation of 500 linear feet of suction main.

Rehabilitation of Other Pump Stations (704)

Purpose

To rehabilitate five active pump stations (Brattle Court, Reservoir Road, Hyde Park, Belmont, and Spring Street). Each of these five stations is more than 40 years old, and are overdue for renewal for safety, reliability, and efficiency reasons.

Project History and Background

MWRA's Waterworks distribution system includes ten active pump stations. Construction of extensive rehabilitation of the James L. Gillis, Newton Street, Lexington Street, and Commonwealth Avenue pump stations is nearing completion. The Dudley Road Pump Station will not be rehabilitated because the station will be abandoned.

The Brattle Court, Reservoir Road, Hyde Park, Belmont, and Spring Street stations are between 40 and 80 years old and are overdue for major rehabilitations. The Brattle Court Pump Station serves the towns of Arlington, Lexington, Waltham, and Winchester. The Reservoir Road Pump Station serves the town of Brookline. The Hyde Park Pump Station serves Boston, Milton, Norwood, and Canton. The Belmont Pump Station serves Belmont, Arlington, and Watertown. The Spring Street Pump Station serves Lexington, Bedford, part of Waltham, Belmont, Arlington, and Winchester.

Some equipment at each pump station is inoperable, and system demand patterns have shifted during the life of the stations, requiring adjustments to pumping capacity. In addition, station improvements have not kept pace with changes in the current building and safety codes.

The construction will be conducted in four contracts. The first contract (Construction Interim Automation) will be based on a fast-tracked design, and involve implementation of the Waterworks Division automatic operation and remote monitoring and control SCADA system at each pumping station. The rehabilitation of the five pump stations will be performed under three construction contracts (contracts 2, 3, and 4), with the work on Hyde Park and Belmont Pumping Stations in Contract 2, Reservoir Road. and Brattle Court Pumping Stations in Contract 3, and Spring Street Pumping Station in Contract 4. The rehabilitation work has been divided into three construction contracts to allow phasing of the work to maintain reliable service to each service area and to provide additional opportunities to construction contractors.

Scope

Subphase	Scope
Conceptual Design	Planning and conceptual design to inspect and evaluate the HVAC, buildings, pipes, valves, and other systems at the pump stations; determine what work needs to be done, and prepare a conceptual design report. The cost of construction will be estimated upon completion of the conceptual design phase.
Design/CS/RI	Design, construction services, and resident inspection for the major rehabilitation of the Belmont, Brattle Court, Spring St., Hyde Park, and Reservoir Rd. pumping stations. Rehabilitation will include installing new pump units, correcting structural and emergency deficiencies, building system replacement, and building and site refurbishment.
Construction-Interim Automation	Construction associated with initial automation at the pump stations.
Construction-Belmont & Hyde Park Pump Stations	Construction associated with the rehabilitation of the Belmont and Hyde Park Pump Station.
Construction-Brattle Court & Reservoir Rd. Pump Station	Construction associated with the rehabilitation of the Brattle Court and Reservoir Rd. Pump Station.
Construction-Spring St. Pump Station	Construction associated with the rehabilitation of the Spring St. Pump Station.

Bear Hill Improvements - Section 29 Rehabilitation (722)

Purpose

To improve the condition of this 96-year old pipeline, since its hydraulic capacity has diminished as a result of rust and sediment build-up. This pipeline, which serves the Northern Intermediate High System, will be rehabilitated through cleaning and lining.

Project History and Background

Section 29 is entirely within Stoneham and serves the Northern Intermediate High Service area. This main is 96 years old and measures 6,300 feet in length and 24 inches in diameter. Sections 9 and Section 89 are the only two supply mains to this service area.

Due to its age and the fact that Section 29 is unlined, sediment build-up has reduced the pipeline carrying capacity to approximately 45 percent of the original design capacity (C-value: 58). In the event of a shut down in Section 89, Section 29 would not be able to meet the minimum hydraulic needs of the area. The sediment build up may also require additional chlorination to maintain water quality and to contribute to solving taste and odor problems.

Scope

Subphase	Scope
Design/CS/RI	Design, construction services, and resident inspection of the rehabilitation of Section 29. Exploratory excavation and corrosion analysis will be performed to evaluate the structural integrity of the pipe, the condition of the bedding material, and the extent of pipe corrosion.
Construction	Rehabilitation of 6,300 linear feet of 24-inch pipe on Section 29. Rehabilitation consists primarily of cleaning and cement mortar lining of the interior pipeline walls, as well as replacement of all main line valves, blow-off valves, and appurtenances.
Easements	Negotiate easements along the pipeline construction section.

James L. Gillis Pump Station Rehabilitation (689)

Purpose

To improve and modernize pumping facilities and equipment at the 90-year old formerly named Spot Pond Pump Station. These improvements will directly benefit the Northern High and Northern Intermediate High systems, and will improve system-wide emergency response capabilities. Project components include rehabilitation of the pump station, installation of a new suction line, rehabilitation of discharge lines, construction of a sanitary sewer, and remediation of a contaminated land site.

Project History and Background

The pump station at Spot Pond use to chlorinate and pump water from the pond to the Northern Intermediate High Service Area (Bear Hill Reservoir) and the Northern High Service Distribution System (Fells Reservoir). The station was built in 1905. Due to the age, condition, and critical need for the facility, the rehabilitation of the pump station was a top priority of the Waterworks Division.

A new 14,500 foot, 60- to 72-inch diameter suction pipeline has been installed from the City Tunnel Shaft in Malden to Gillis Pump Station. This provides the station with water at a pressure head greater than the pond, significantly reducing the pumping requirement, and eliminating the need to take water from an uncovered water source, in compliance with the requirements of the Safe Drinking Water Act. Spot Pond open reservoir was removed from active service in 1977.

The pipeline will improve the reliability of the system by providing increased capacity to transfer water between the low and high service systems during emergencies and facilitate future use of the Fells Reservoir covered storage facility as the main distribution reservoir for the Northern High Service System.

To provide adequate discharge capability, rehabilitation of 9,000 feet of Sections 13 and 64 is included. These 36-inch diameter mains extend from the pump station to the Fells Reservoir, and deliver water to Melrose and Stoneham. Because the structural integrity of these pipelines has been determined to be sound, rehabilitation rather than replacement is now planned. This will improve carrying capacity, reduce friction and turbulence, and reduce the risk of water quality impairment.

This project also includes a major improvement to the layout of valves between the pump station and Fells Reservoir.

A 1,500-foot sanitary sewer will also be constructed to replace an existing septic system that serves the pump station and the adjacent Botume house. Sewerage from both facilities will be pumped by a small ejector station to an existing MDC sewer on Pond St. in Stoneham.

During design of the pump station rehabilitation, several environmental problems were discovered including contamination of on-site soil, groundwater, and the adjacent brook. Under emergency order MWRA and the Department of Environmental Protection (DEP) have worked together to eliminate the sources of contamination at the pump station. MWRA will complete the cleanup process at the site, as required by DEP.

The Gillis Pump Station project also involves evaluation of the environmental conditions of the site and the nearby Spot Pond Brook area and the preparation and implementation of a remedial cleanup plan. This portion of the project is comprised of three phases and will follow the Massachusetts Contingency Plan as specified by DEP. The first phase (study) consists of an environmental assessment to determine the type and extent of contamination. The second phase (Feasibility Study/Remedial Response Plan) includes a risk assessment to determine the level of risk to the environment and to the public, and the development of a plan of necessary corrective actions. The third phase (Implementation of Remedial Response Plan) consists of performing the corrective action and restorative work specified in the remedial response plan.

Scope

Subphase	Scope
Pump Upgrade	Upgrade existing pump units pumping to the Bear Hill covered reservoir.
Electrical Upgrade	Electrical system upgrade to provide power for the 300 HP and 500 HP motors added for pumping to Bear Hill Reservoir. Includes site preparation, masonry work, and new conduits and control panels.
Design-Diesel Exhaust	Design for the replacement of the exhaust systems on existing diesel pumps.
Construction - Diesel Exhaust	Replacement of the exhaust systems on existing diesel pumps.
Design/CS/RI-Pump Station	Design, construction services, and resident inspection for major rehabilitation of the pump station including all new pump units, emergency generators, building systems replacement, and building and site refurbishment.
Construction Phase 1	Construction of immediate rehabilitation of the pump station building which includes space for a new control facility. Refurbish five existing pumps, three diesel engines, and other ancillary equipment so that operations can continue until new equipment is installed.
Construction Phase 2	Installation of eight new pump units, two emergency generators, replacement of all mechanical and electrical systems, and complete building and site refurbishment.
Spot Pond Pump Station Engine 29	New electric drive for Pump # 29 to improve the station's reliability during the renovation period. A 24-inch check valve will be removed from the discharge line and replace a pipe spool piece.
Oil Control Plan	Development and implementation of an oil control plan to eliminate the sources of contamination in the floor drainage.

Drain Line Cleaning	Cleaning of floor drains to eliminate oil contamination drainage into Spot Pond.
Des/CS/RI-Suction Pipe	Study to determine the best method to reduce high water service to the low service gradient of Spot Pond.
Study - Suction Pipe	Design, construction services, and resident inspection of a new 14,500 linear feet, 60- to 72-inch diameter suction pipeline.
Construction-Suction Pipe	Construction of a 14,500 linear feet, 60- to 72-inch diameter suction pipeline to pump water from the gradeline of the City Tunnel rather than from the low service system to the Northern High Service System.
Hydraulic Transient Analysis	Sizing and locating air release and vacuum valves at points along distribution lines 13 and 29 which will relieve potentially damaging pressures occuring during winter hammer.
Paving-Highland Ave	Full width overlay of Highland Ave. in Malden from Elm St. to Fells Way.
Design-Rehabilitation Discharge	Design for the rehabilitation of 7,355 linear feet the 36-inch main for Sections 13 and 64.
Construction-Rehabilitation Discharge Main	Rehabilitation of 7,355 linear feet of 36- inch main for section 13 and 64.
Design-Sewer	Design of a 1,500 linear feet sanitary sewer which will be constructed to facilitate abandonment of the existing septic system that serves the pump station and adjacent Botume House.
Construction - Sewer	Construction of the sanitary sewer in order to conform with DEP requirements.
Fells Area Paving	Road stabilization along Woodland Rd. (north of Ravine Rd.), Pond St., and South St. which were affected by the Gillis Pump Station and Fells Covered Storage projects.
Technical Assistance	Technical assistance in the design and construction of the pump station, suction pipeline, discharge pipeline, and covered storage, for development of the remedial response plan.
Environmental Assessment & Remediation Plan	Determine the nature and extent of contamination at the pump station and area, conduct a risk assessment to determine the level of risk to the environment and to the public, and develop a remedial action plan.
Remedial Action Plan	Monitor restorative work specified in the remedial action plan.
DEP Review Fee	Fee paid to the Department of Environmental Protection for review of corrective measures to eliminate the sources of contamination at the site.

Weston Aqueduct Supply Main 4 (WASM 4) (703)

Purpose

To improve the condition and carrying capacity of this major supply line presently serving the High and Low Service systems.

Project History and Background

WASM 4 was constructed in 1932 and is 66 years old. It is mostly unlined steel pipe, has low C-values, and experiences leaks at an above average rate. Rehabilitation by replacement, sliplining, cleaning and lining, and valve replacement will address these factors and also provide flexibility to operate this line on high service or low service as may be needed.

WASM 4 is a predominantly 60-inch diameter pipeline consisting primarily of unlined steel with some prestressed concrete cylinder and cast iron sections. It extends 47,000 linear feet from Weston through Newton, Watertown, and Boston into Cambridge.

WASM 4 was originally part of the Low Service System and conveyed water from the Weston Aqueduct to the Spot Pond Supply Mains. Upon completion of the Hultman Aqueduct, and its interconnection to the Weston Aqueduct Terminal Chamber in 1941, and the addition of Newton to our member communities in the early 1950s, the western portion of WASM 4 was transferred to the High Service system as a temporary means of conveying water from the Hultman to portions of Newton and Watertown while still maintaining supply to the Spot Pond Supply Mains at its east end through pressure reducing valves.

Until recently, the middle portion of WASM 4 along Nonantum Road was shut down due to an excessive leakage rate. The Nonantum Road construction (rehabilitation by sliplining and cleaning and lining) is now complete and the western portion of WASM 4 is currently being used to supply about three mgd to portions of Newton and Watertown (Meters 103, 104, and 105) and its connections to the Southern High mains (Sections 23, 24 and 47) are open. The eastern portion of WASM 4 is currently being used to transfer water from the City Tunnel via Shaft 8 pressure reducing valves to the Spot Pond Supply Mains.

WASM 4 does not have sufficient capacity to satisfy a peak flow of approximately 40 mgd, and during the past 30 years the pipeline has experienced 84 reported breaks; 60 percent of those breaks have occurred during the last ten years.

In order to remove WASM 4 from service to allow it to be rehabilitated, alternative supplies must be provided for Watertown Meter 103 and Newton Meters 104 and 105. Meter 103 is being upgraded and local water main improvements are being built along Galen St. in Watertown. These

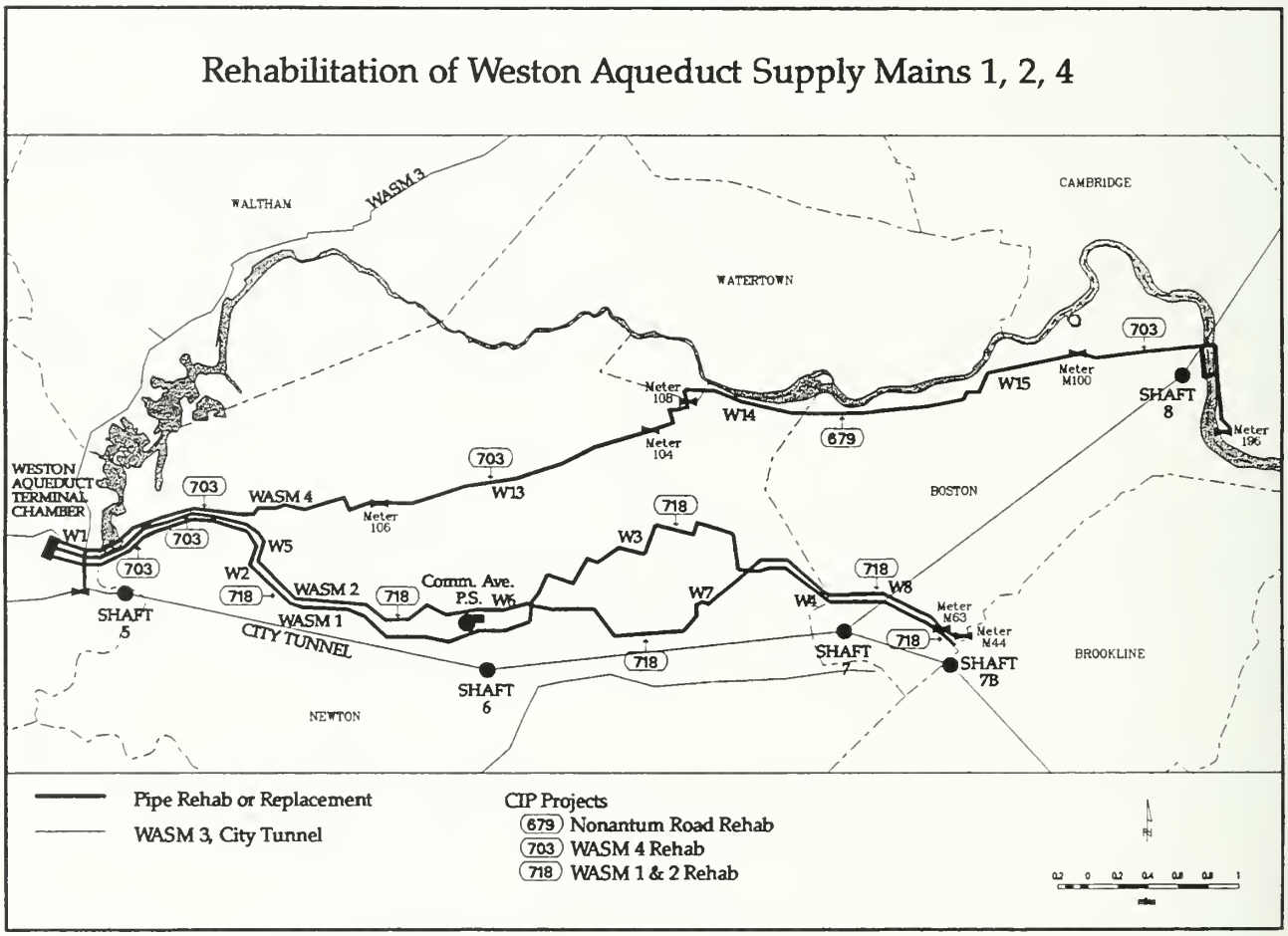
efforts, when completed, will allow the other Watertown meters to temporarily supply the area normally served by Meter 103. These improvements are being constructed as non-participating bid items (i.e., funded by MWRA) under a contract administrated by Mass Highway Department. Alternative sources for the Newton northern pressure district, normally supplied by Meters 104 and 105, have been constructed. Two pressure reducing valves, one at Chestnut St. and one at Walnut St., were installed that will allow the southern pressure district that is supplied by the Commonwealth Avenue Pumping Station to temporarily serve the northern pressure district. The Chestnut St. PRV has been tested and has been recently used during a leak repair on WASM 4. The Walnut St. PRV remains to be tested.

WASM 4, when rehabilitated, will be able to operate as it currently does, as a high service main from the Hultman Aqueduct Branch up to the pressure reducing valve facility at Nonantum Rd., continuing as a low service main to its connections with the East and West Spot Pond Supply Mains. WASM 4 will also have the capability to operate completely as a low service main. This flexibility in operating conditions will allow WASM 4 to best support the system. When in the split high/low mode, WASM 4 can support WASM 3 through the planned connecting mains during planned shutdowns or emergencies; this support has significantly reduced the cost of the New Connecting Mains - Shaft 7 to WASM 3.

Scope

Subphase	Scope
Design/CA/RI	Design, construction administration, and resident inspection for the rehabilitation of Sections 1W, 13W, 14W, 15W, and portions of 2W and 5W.
Appraisal/ Easement	Easements along the construction route.
Construction Commonwealth Ave - CP2 Newton	Cleaning and lining of 5,300 linear feet of 48-inch and 12,300 linear feet of 60-inch diameter mains of WASMs 1, 2, and 4 (Sections 2, 5, 13, & portions of 1) from Weston across the Charles River along Commonwealth Avenue to the Mass Pike in Newton, as well as replacement of existing line valves, air/vacuum valves, and blow-off valves.
Construction - Washington St - CP3 Newton	Cleaning and cement lining of 21,200 linear feet of 60-inch pipe on WASM 4 (Sections 13 and 14) along Rowe, Webster, Elm and Washington streets in Newton and 5,800 linear feet of 60-inch pipe on WASM 2 (Section 2) along Commonwealth Ave. from Bullough Parkway to Grant Ave. Rehabilitation of Meters 104 & 105, and the Nonantum Rd. PRV, and sliplining of 1,600 linear feet of pipe from Brooks St. to North Beacon St..
Construction- Western Ave. (Brighton) - CP4	Sliplining with some limited pipe replacement and cement lining of 10,538 linear feet of 60-inch pipe mostly along Western Ave, 1,008 linear feet of 42-inch pipe mostly along Memorial Drive, 808 linear feet of twin parallel 30-inch pipes within the Western Avenue Bridge, and the replacement of Master Meter 100.
Construction- Galen St Meter 103	Payment to the Massachusetts Highway Department for installation of a new meter, check valve, vault and appurtenances for the rehabilitation of Meter 103.

Construction-MDC Bridge Crossing Boston/ Cambridge	Replacement of the two of parallel 30-inch mains, totaling 774 linear feet, within the River St. bridge.
Construction 2 - Newton Water Mains	Rehabilitation consisted of cleaning and lining of 8,700 linear feet of 12-inch diameter community pipeline, as well as installation of two new pressure reducing valves and upgrades at Meter 105.
Technical Assistance	Provide technical assistance for the Construction 1 and Newton Water Main phases.


Rehabilitation of Weston Aqueduct Supply Mains 1, 2, 4
WALTHAM
WASM 3
CAMBRIDGE
WATERTOWN
703
Meter 108
W14
679
W15
Meter M100
SHAFT 8
Meter 196
Meter 104
703
W13
WESTON AQUEDUCT TERMINAL CHAMBER
703
WASM 4
Meter 106
BOSTON
718
W3
W1
703
W5
703
W2
718
WASM 2
718
Comm. Ave. P.S. W6
W7
W4
718
W8
Meter M63
Meter M44
SHAFT 5
WASM 1
CITY TUNNEL
718
SHAFT 7
718
SHAFT 7B
BROOKLINE
SHAFT 6
NEWTON
Pipe Rehab or Replacement
WASM 3, City Tunnel
CIP Projects
679 Nonantum Road Rehab
703 WASM 4 Rehab
718 WASM 1 & 2 Rehab
N
0.2 0 0.2 0.4 0.6 0.8 1
miles

Spot Pond Supply Mains - Rehabilitation (713)

Purpose

To improve the condition, carrying capacity, and valve operability of the two long supply mains which extend north from Chestnut Hill to Spot Pond. These cast-iron mains, which are 100 years old, deliver water to the Northern Low Service System. Improvements will involve a combination of replacement, cleaning and lining, and valve replacement/installation, depending on specific site conditions and needs. By improving these supply lines, the need to take water from the City Tunnel to augment the low service system will be reduced and water quality to eight user communities will be improved.

Project History and Background

The East and West Spot Pond Supply Mains (SPSMs) serve the Northern Low Service Area, including portions of Brighton, East Boston, Charlestown, Chelsea, Malden, Medford, Somerville, and Everett. The lines are designed to fully supply Cambridge during drought or emergency. Cambridge is currently scheduled to be supplied by the Spot Pond Mains during construction of a new water treatment plant from 1998 to 2001. The mains have historically supplied Spot Pond and subsequently the formerly named Spot Pond Pump Station (new name is the James L. Gillis Pump Station). With the closure of Spot Pond as a water supply source and the construction of the Spot Pond Suction Main, Section 99 as the primary supply to the Gillis Pump Station, the Spot Pond Supply Mains will now normally serve as distribution mains to the eight communities and will provide emergency backup supply to the Gillis Pump Station. In the event Section 99 is out of service, the station would take suction directly from these mains, rather than from Spot Pond.

The East Spot Pond Supply Main consists of 61,000 linear feet of mostly 48-inch diameter pipeline which passes through Brookline, Boston, Cambridge, Somerville, Medford, Malden, Melrose, and Stoneham.

The West Spot Pond Supply Main consists of 53,000 linear feet of 48-inch and 60-inch diameter pipeline which passes through Brookline, Boston, Cambridge, Somerville, Medford and Stoneham.

The carrying capacity of the 100-year old mains has been significantly reduced from their original design capacity due to a build up of rust deposits (tubercules) and other matter along the pipeline walls which contributes to water quality deterioration in the low service system. The ability of the mains to withstand service pressures is drastically reduced in some areas due to exterior corrosion of the pipe. In addition, inoperable or poorly operating valves along the line make isolation, or rerouting of flow, difficult to implement in the event of a break.

Portions of the SPSMs in Brookline, primarily on Beacon St., are to be rehabilitated under the Boston

Low Service Pipe and Valve Rehabilitation project.

Section 67 is included in this rehabilitation project because it provides connection between the East and the West Supply Mains from Section 11 at Porter Square to Section 4 at Union Square. Section 67 consists of 6,900 linear feet of 48-inch diameter steel pipeline (constructed in 1949). Rehabilitation of this main is needed because of the age of the pipe and the critical role of the main in providing flow to the respective East and West mains during shut downs for inspection and construction.

A portion of Section 16W (Weston Aqueduct Supply Main 3) is now to be included with the construction of this project rather than with the Northern Low Service Pipeline Replacement due to significant operational and geographic overlaps in these facilities.

Restoration of design capacity, structural integrity, and internal lining of these mains is required to ensure adequate peak and emergency flow to user communities to alleviate water quality deterioration and to provide emergency back-up to the Northern High System via the Gillis Pump Station. The planned reconfiguration of the water distribution system provides for the Spot Pond Supply Mains to be fed from the City Tunnel Extension only during periods of peak demand. A portion of the supply will be provided by Weston Aqueduct Supply Mains 1 and 2 (WASM 1 & 2), which will be connected to the new covered storage reservoir on Loring Rd. in Weston being constructed as part of the MetroWest Tunnel project. Most of its supply will be from WASM 4 which connects to the East and West Spot Pond Supply Mains Western Avenue Bridge and on Memorial Drive at Magazine Beach.

This project will facilitate the unification of the Boston Low and Northern Low Service Areas into one service area and will improve pressures to the far reaches of the Northern High Service Area by reducing the demand burden on the City Tunnel Extension. Water quality will be improved to eight communities through elimination of 18 miles of deteriorated pipe.

Scope

Subphase	Scope
Preliminary Design and Design/CA/RI	Preliminary design, design, construction administration, and resident inspection of rehabilitation/replacement of Sections 3, 4, 5, 6, 7, 9, 10, 11, 12, 67, and a portion of Section 2 and 16W.
Construction CP1	Construction will proceed in three phases as follows: Phase I (2002-2004) will involve the rehabilitation/replacement of 10,600 linear feet of 48-inch pipe and 260 linear feet of 64-inch pipe on Section 6/6A; 13,800 linear feet of 48-inch pipe on Section 7; 6,900 linear feet of 48-inch pipe on Section 67; 200 linear feet of 48-inch pipe on Section 10 ("10a"); and 3,000 linear feet of 48-inch pipe on Section 11 ("11a").

Construction CP2	Phase II (2004-2006) will involve the rehabilitation/replacement of 8,225 linear feet of 48-inch pipe on Section 9; 19,900 linear feet of 48-inch pipe on Section 4; 1,600 linear feet of 48-inch pipe on Section 5; and the remaining portion of Section 10 ("10b"), i.e.- 365 linear feet of 48-inch pipe, 430 linear feet of 36-inch pipe and 530 linear feet of 30-inch pipe.
Construction CP3	Phase III (2006-2008) will include 350 linear feet of Section 2; 1,130 linear feet of Section 3; 10,400 linear feet of 48-inch pipe and 6,350 linear feet of 60-inch pipe on Section 12; 1,000 linear feet of 60-inch pipe on Section 16W (WASM 3); and remaining portions of Section 11 ("11b"), i.e. - 12,100 linear feet of 48-inch pipe.
Construction CP4	Early Valve Replacement Contract to install nine mainline valves and associated blow-offs, permanent bypass piping to meters and air valves. Also remove pipe at 3 locations for materials and strength testing.
Early Valve Equipment Purchase	Purchase of long-lead time equipment to expedite and support early valve replacement-CP4.
Easements CP1	Easements along the construction route of CP1.
Easements CP2	Easements along the construction route of CP2.
Easements CP3	Easements along the construction route of CP3.

Northern Low Service Pipeline Replacement (690)

Purpose

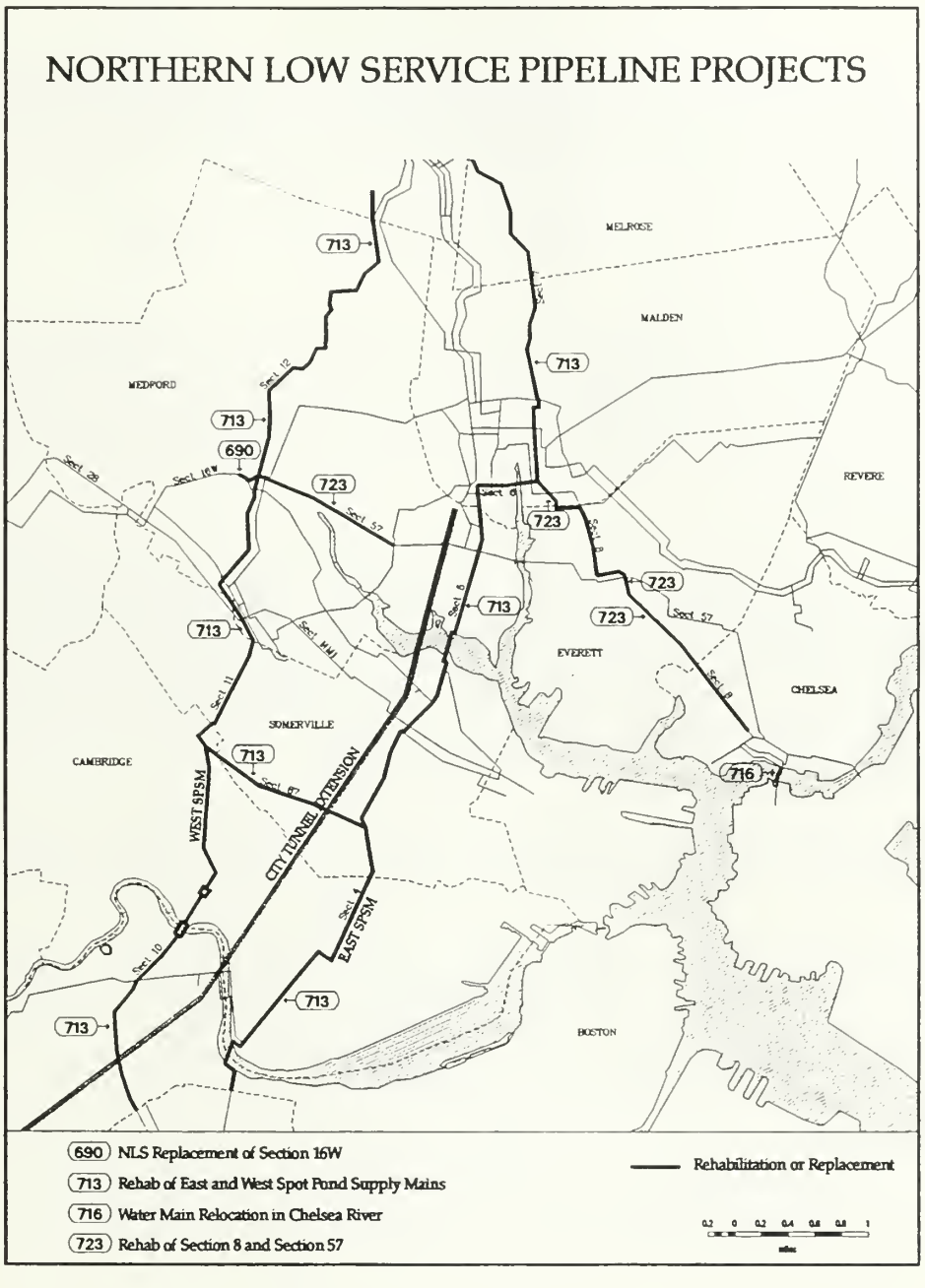
To repair segments of section 16W of the Northern Low Service System that experience excessive leakage and require frequent maintenance. The portion of the pipeline to be rehabilitated is in the vicinity of Mystic Valley Parkway near Medford Square. The rehabilitation project will involve sliplining a portion of the existing pipe with new pipe, cleaning and lining a portion of the existing pipe, valve replacement, valve chamber rehabilitation, and cathodic protection of the pipeline.

Project History and Background

The Medford section (Section 16W) of the Northern Low Service Pipeline is in need of repair. The pipeline currently is part of the feed pipeline for Spot Pond in Stoneham. This pipeline was built in the 1930s and suffers from corrosion due to electrolysis and corrosive soils from the tidal flats of the Mystic River. The corrosion levels have led to excessive leaks, resulting in high maintenance costs. Due to an increased amount of leaks along the portion of the pipeline directly under the parkway, and the subsequent loss of pipeline wall thickness, the Waterworks Division has accelerated the rehabilitation of a portion of Section 16W pipeline. The design for this segment was completed by in-house staff. The design and construction of the remaining portion of Section 16W that was originally scheduled for rehabilitation under this project will be completed under Spot Pond Supply Mains Rehabilitation.

Scope

Subphase	Scope
Design/CS/RI-Section 16W Medford	Design, construction services, and resident inspection for the rehabilitation and/or replacement of a portion of section 16W, rehabilitation of an existing pressure reducing valve vault, replacement/elimination of connecting piping, valve replacement, and cathodic protection of the pipeline.
Construction-Section 16W Medford	Construction work will consist of rehabilitation by cleaning and lining approximately 280 linear feet of 60-inch steel pipeline, sliplining 220 linear feet of 60-inch pipe with new 54-inch pipe, rehabilitating a valve vault, replacing two valves, and installing a cathodic protection system.
Easements	Easements along the construction route.


NORTHERN LOW SERVICE PIPELINE PROJECTS
MELROSE
MALDEN
MEDFORD
REVERE
EVERETT
CHELSEA
SOMERVILLE
CAMBRIDGE
BOSTON
713
690
723
716
Sect 12
Sect 16W
Sect 28
Sect 57
Sect 6
Sect 8
Sect MH
Sect 11
Sect 10
Sect 4
WEST SPSM
CITY TUNNEL EXTENSION
EAST SPSM
690 NLS Replacement of Section 16W
713 Rehab of East and West Spot Pond Supply Mains
716 Water Main Relocation in Chelsea River
723 Rehab of Section 8 and Section 57
Rehabilitation or Replacement
0.2 0 0.2 0.4 0.6 0.8 1
miles

Water Main Relocation in Chelsea River (716)

Purpose

To relocate the Section 8 water main which crosses the Chelsea River due to a planned dredging operation by the U.S. Army Corps of Engineers and the Massachusetts Port Authority (Massport). A new pipeline will be installed at a lower depth to maintain service for Logan Airport and East Boston.

Project History and Background

Section 8, and two parallel segments of Section 38, one of which is active, traverse the portion of the Boston Harbor known as the Chelsea River and provide nearly all the water for East Boston and Logan Airport. The inactive segment of Section 38, which lies parallel to the active portion of Section 38, can still function as a back-up to contribute very limited flow to these areas during preventive maintenance.

The U.S. Army Corps of Engineers has notified MWRA of its intent to deepen and widen the Chelsea River channel to improve ocean access for large fuel tankers. This work is expected to take place within three years and will result in a river depth of approximately 38 feet below the mean low water (MLW) level. The top of Section 8 is approximately 39 feet below MLW. This pipeline, which is in the over-dredging zone, will have to be relocated if the project proceeds. The two Section 38 pipelines are approximately 43 feet and 35 feet below MLW.

The older, inactive Section 38 pipeline will be removed and not replaced. The newer, active Section 38 pipeline, the top of which is at approximately 43 feet below MLW, will not be disturbed.

Under federal statutes governing navigable waterways, the federal government has the preeminent right to carry out improvements and operations without compensation to local utilities for damages which may occur as a consequence. Therefore, MWRA is responsible for relocating the affected pipelines prior to the dredging operations of the Corps. MWRA and Massport have worked out a funding agreement by which funds in the amount of $2.5 million or 50 percent of the total cost of the water main relocation, whichever is the lesser, will be provided to MWRA by Massport from proceeds of a $15 million authorization in the Seaport Bond Bill. The initial costs in FY98 and FY99 for the water line relocation design contract and a portion of other future construction costs will be funded by Massport in accordance with the terms of an MOU with MWRA executed on May 21, 1997.

Because this portion of the distribution system has no storage capacity, two active pipelines are required at all times to meet the needs of East Boston and Logan Airport. Therefore, it is essential that one new pipeline be constructed because of the dredging (Section 8). Without an adequate

backup pipeline, any shutdown along one of the two active lines due to maintenance activities or a water main break would severely disrupt flows to Logan Airport.

Scope

Subphase	Scope
Planning/ Design/CA/RI	Planning, design, construction administration, and resident inspection for the relocation of Section 8.
Construction	Construction of approximately 950 linear feet of 48-inch diameter pipeline for Section 8, at a level below the mean low water line of 40 feet.

Northern Low Service Rehabilitation - Sections 8 and 57 (723)

Purpose

To improve the condition and reliability of two unlined pipe segments serving a portion of the Northern Low System. These pipes, Sections 8 and 57, have reduced carrying capacities because of rust build-ups, and have experienced leaks at above average rates. Improvements will consist primarily of replacement of a portion of Section 8 and cleaning, lining, and valve repairs along nearly three miles of water main.

Project History and Background

Section 8 was installed between 1897 and 1913 and serves Malden, Everett, Chelsea, and East Boston. Section 57 was installed in 1938 and serves Malden, Medford, Everett, Chelsea, and East Boston.

The Section 8 pipeline is currently functioning at approximately 45 percent of its original carrying capacity (C-Value: 60) due to the build up of rust deposits and other matter along the pipeline walls. The Section 57 pipeline has experienced five leaks during the last three years. This main is currently functioning at approximately 60 percent of its original carrying capacity (C-Value: 85) due to the build up of rust deposits and other matter along the pipeline walls.

Scope

Subphase	Scope
Design: Section 8	Design for the rehabilitation and replacement of Section 8. Test pit excavation and corrosion analysis performed during the preliminary design phase will evaluate the structural integrity of the pipe, the condition of the bedding material, and the extent of pipe corrosion. The results of these analyses will indicate the amount of pipeline which will have to be replaced.
Easements: Section 8	Easements along the pipeline construction route.
Construction: Section 8	Construction will consist of cleaning and cement mortar lining of the pipeline interior, replacement of all defective and inoperable valves, and the strategic addition of new valves for 7,500 linear feet of 48-inch pipe on Section 8 in Malden and Everett. Replacement consists of 9,722 feet of obsolete 42-inch pipeline with new 36-inch ductile iron main and replacement of all necessary valves and blow-off connections from Second St. in Everett to the Mystic River Bridge in Chelsea.
Design: Section 57	Design for the rehabilitation of Section 57. Test pit excavation and corrosion analysis performed during the preliminary design phase will evaluate the structural integrity of the pipe, the condition of bedding material, and the extent of pipe corrosion. The results of these analyses will indicate the amount of pipeline which will have to be replaced.

Easements: Section 57	Easements along the pipeline construction route.
Construction: Section 57	Rehabilitation will consist of cleaning and cement mortar lining of the pipeline interior, replacement of all defective and inoperable valves, and the strategic addition of new valves for 8,120 linear feet of 48-inch pipe on Section 57 in Medford.

New Connecting Mains - Shaft 7 to WASM 3 (702)

Purpose

To provide redundancy and improve reliability of WASM 3, and to facilitate the future rehabilitation of WASM 3; to provide hydraulic looping and redundancy, and to facilitate rehabilitation of the High Service dead end Sections 23/24, 47, and the Watertown Branch; to enable the Intermediate High Sections 59 and 60 to be taken off-line for rehabilitation; and to improve water quality by reducing the length of unlined cast iron water mains in the MWRA's system. In meeting the project goals, the basis for a strong hydraulic network of piping between WASM 3, WASM 4, the City Tunnel, and the future Metropolitan Tunnel Loop will be provided. The future conversion of Sections 23/24 to the Intermediate High Service to create a unified Intermediate High Service area connecting the Belmont and Commonwealth Avenue Pumping Stations will be possible. This project will involve installation of 31,415 linear feet of new pipeline, and rehabilitation of 62,910 linear feet of pipeline.

Project History and Background

WASM 3 is a 56- to 60-inch diameter steel main installed in 1926. Upon completion of the Hultman Aqueduct and its interconnection to the Weston Aqueduct Terminal Chamber in 1941, WASM 3 was transferred to the high service system. WASM 3 is connected to the Hultman Aqueduct Branch at one end and the City Tunnel at its other end. WASM 3 extends from Weston near Shaft 5 to Somerville at Shaft 9. Most of the flow comes from Shaft 5, with peak flows of 57 mgd. A lesser amount enters the main from Shaft 9. There are no connecting mains along the length of this 11-mile pipeline, and no other means available to adequately supply the nine communities served by this line.

WASM 3 provides service to the communities northwest of Boston and is the sole source of supply to the Northern Extra High Service Area (Bedford, Lexington, Waltham, Arlington, and Winchester) and the Intermediate High Service Area (Belmont, Arlington, and Watertown). It also supplies a portion of the Northern High Service Area (Waltham, Watertown, Belmont, Arlington, Medford, and Somerville), and is a means of supplying the Spot Pond Reservoir. The population served by WASM 3 is about 190,000.

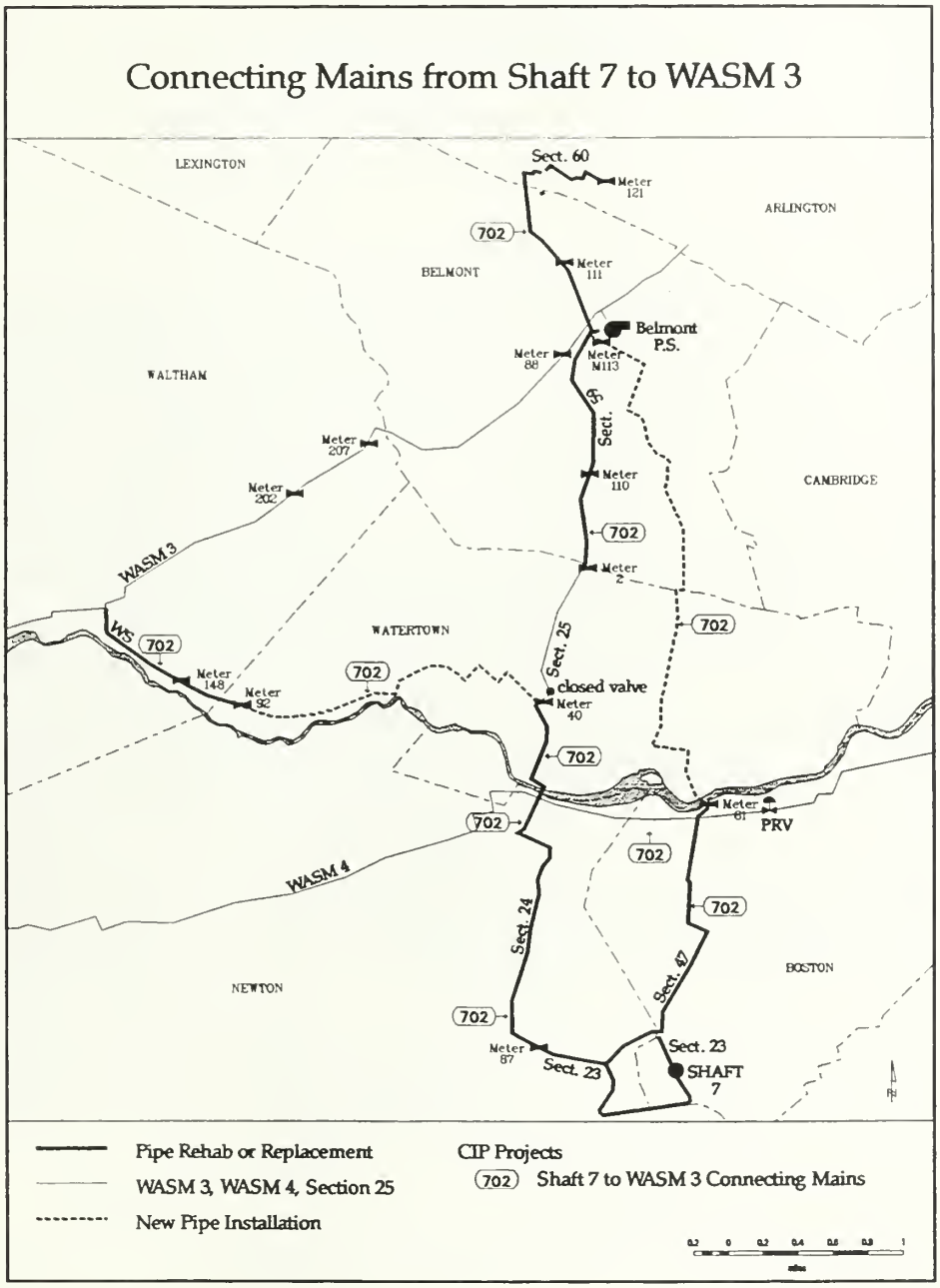
A break almost anywhere on this pipeline would result in severe service disruptions in Waltham, Watertown, Arlington, Lexington, Bedford, Winchester, and Belmont. Virtually no water would reach Waltham if a break were to occur at the southern end of the pipeline; water normally supplied through the Shaft 5 connection would be forced through the Shaft 9 connection, increasing flows and reducing hydraulic grade lines in both WASM 3 and the City Tunnel. The lack of redundancy also makes routine cleaning and lining of the 70-year old pipeline impossible. The need for maintenance is indicated by a significant number of leaks, particularly on the most vulnerable Southern section, which are the result of corrosion pitting through the pipe wall, as well as by the reduced carrying capacity of the line.

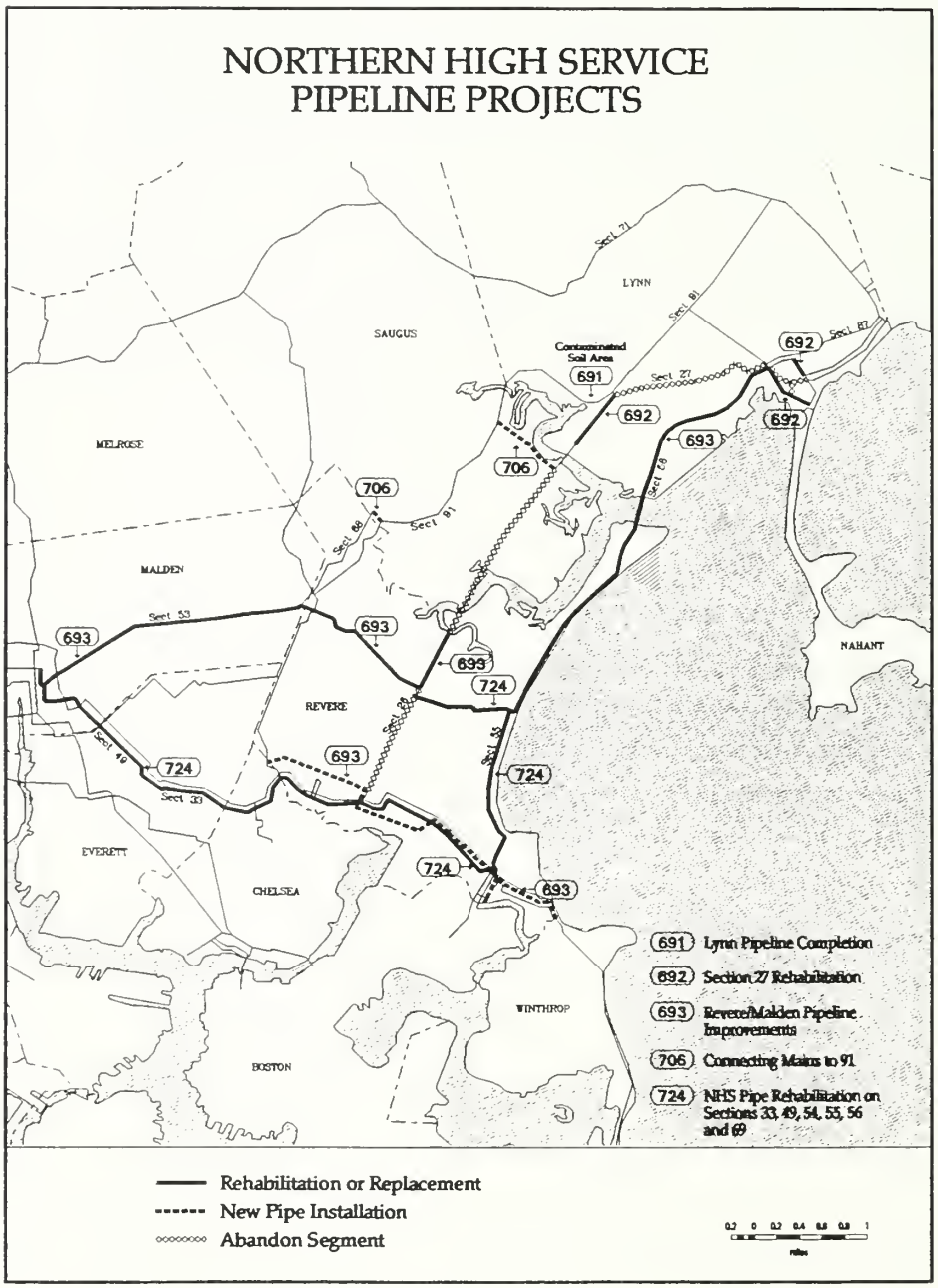
This project has been configured to convey high service water from WASM 4 to WASM 3 and to improve the capability to convey water from Shaft 9 of the City Tunnel to WASM 3. This will be accomplished by rehabilitating or replacing existing dead-end mains from the City Tunnel and WASM 3, and connecting these mains by constructing new pipelines, such that transmission loops will be formed between the City Tunnel and WASM 3. A goal of this project is to make it possible to rehabilitate the Intermediate High System; the new pipelines built to loop the high system could temporarily be used as intermediate high mains allowing for rehabilitation or replacement of Sections 59 and 60. The rehabilitation of WASM 4 is also closely related to this project, because WASM 4 will be interconnected to the new connecting mains of the Shaft 7 to WASM 3 project. WASM 4, which can be operated on high or low service, runs from Shaft 5 to Shaft 8, midway between the City Tunnel and WASM 3. Using WASM 4 as a supply means for the new connecting mains has resulted in cost savings by delaying or eliminating a proposed new pipeline south of WASM 4 to a Shaft 7 connection. This project has evolved from the "Shaft 7 to WASM 3" connecting mains to the WASM 3 and 4 connecting mains.

Scope

Subphase	Scope
Routing Study	Identification of alternatives to determine the optimum approach for providing additional strong connection(s) to WASM 3.
Design/CA/RI - North Segment & Intermediate High	Design, construction administration, and resident inspection of the North Segment and Intermediate High Sections 59 & 60.
Construction - North Segment (CP1)	**North Segment:** Installation of 19,100 linear feet of new 48-inch connecting main from WASM 4 to WASM 3.
Construction- Intermediate High (CP2)	**Intermediate High:** Rehabilitate (cleaning and lining) 16,400 linear feet of 20-inch diameter pipe on Section 59 and 60 from Section 25 in Watertown to Meter 121 in Arlington.
Easements - North Segment and Intermediate High	Easements along the construction routes for the North Segment and Sections 59 and 60.
Design/CA/RI - South Segment	Design, construction administration, and resident inspection of the Sections 23, 24, and 47.
Construction - South Segment (CP3)	**South Segment:** Installation of 345 linear feet of 24-inch pipe from Shaft 7 to Section 47. Cleaning and lining of 8,290 linear feet of 20-inch pipe (Section 47) from Meter 120 to WASM 4, 1,957 linear feet of 36-inch (Section 23) and 12,943 20-inch (Section 24 and 47 remaining portion) pipe, and 350 linear feet of 20-inch pipe along Section 24 from WASM 4 to the north side of the Charles River.
Easements - South Segment	Easements along the construction routes for Sections 23, 24, and 47.

Design/CA/RI - West Segment & Watertown Branch	Design, construction administration, and resident inspection of the west segment and the Watertown Branch.
CP4 Construction - West Segment & Watertown Branch	Installation of 12,050 linear feet of 36-inch water main from Section 24 at the Charles River to the Watertown Branch, including a 16-inch connection to the new Newton meter. Cleaning and lining of 5,770 linear feet of 30-inch pipe (Watertown Branch) along with the installation of a full size 30-inch connection to WASM 3.
Easements - West Segment & Watertown Branch	Easements along the construction routes for the west segment and the Watertown Branch
Watertown MOU (constructed by MHD)	Payment to the City of Watertown to reimburse them for a portion of their Galen St. project that will replace their existing 10-inch diameter pipeline with a new 12-inch diameter water main.


Connecting Mains from Shaft 7 to WASM 3
LEXINGTON
ARLINGTON
BELMONT
WALTHAM
WATERTOWN
CAMBRIDGE
NEWTON
BOSTON
Sect. 60
Meter 121
Meter 111
Belmont P.S.
Meter 88
Meter M113
Sect. 59
Meter 207
Meter 202
Meter 110
Meter 2
WASM 3
WS
Meter 148
Meter 92
Sect. 25
closed valve
Meter 40
Meter 61
PRV
WASM 4
Sect. 24
Sect. 47
Meter 87
Sect. 23
SHAFT 7
702
Pipe Rehab or Replacement
WASM 3, WASM 4, Section 25
New Pipe Installation
CIP Projects
702 Shaft 7 to WASM 3 Connecting Mains


NORTHERN HIGH SERVICE
PIPELINE PROJECTS
LYNN
SAUGUS
MELROSE
MALDEN
REVERE
NAHANT
EVERETT
CHELSEA
WINTHROP
BOSTON
Contaminated Soil Area
691
692
693
706
724
Sect 21
Sect 27
Sect 33
Sect 49
Sect 53
Sect 54
Sect 55
Sect 68
Sect 69
691 Lynn Pipeline Completion
692 Section 27 Rehabilitation
693 Revere/Malden Pipeline Improvements
706 Connecting Mains to 91
724 NHS Pipe Rehabilitation on Sections 33, 49, 54, 55, 56 and 69
Rehabilitation or Replacement
New Pipe Installation
Abandon Segment

Northern High Service - Connecting Mains to Section 91 (706)

Purpose

To integrate the new Section 91 pipeline with the existing grid network in the northeast portion of the Northern High Service system. Through various new connections, service pressures and reliability to community meters will be improved.

Project History and Background

Sections 91 and 92, installed under the Northern High Service Pipe Improvements-Lynn Pipeline project, have been completed except for a small segment of Summer St. This major new transmission main will greatly improve flows and pressures to the entire northeast portion of the High Service Area. To gain the full benefit of this main, branches need to be constructed to connect into existing and proposed community meters as well as to existing MWRA mains. Three connections will serve this purpose.

The first connection is between Section 91 and Section 68 and will pass through Revere and Saugus and serve both towns. While the current pressure and flow rate of the existing Section 68 is considered adequate under average flow conditions, it does not meet the maximum day plus fire flow service goal defined in the Waterworks Master Plan for Saugus Meter 134.

The second proposed pipeline connects Section 26, a 16-inch diameter water main, to Section 91. Which the existing Section 26 provides adequate service under average flow conditions, the line does not meet the maximum day plus fire flow service goal.

The third proposed pipeline would have connected Section 91 with Section 71. Subsequent hydraulic analysis and a shift in priorities within the Waterworks Division has resulted in the elimination of this pipeline from further consideration. Should future priorities change and the pipeline is necessary, a new project will be developed.

These improvements will fully integrate the new Section 91 into the Northern High Service Distribution System. Section 91 will become the primary feed for Saugus, and its increased capacity will improve the hydraulics for the town.

Scope

Subphase	Scope
Design/CA/RI	Design, construction administration, and resident inspection of Section 91 interconnections to Sections 26 and 68.

Easements	Easements along the construction route.
Construction	Installation of a 900 foot length of 24-inch diameter water main on Park St. in Saugus to connect Section 91 to Section 68 and Saugus Meter 134 and construction of a new 3,800-foot water main of 16-inch diameter pipe on Ballard St. in Saugus to complete a loop betweeen Section 26 and Section 9.

Northern High Service Improvements - Lynn Pipeline (691)

Purpose

To install a new primary supply line for the northeast section of the Northern High Service System. The furthest reaches of this service area frequently experience hydraulic deficiencies because of the inadequate capacities of existing pipelines. When this new main comes on line, it will efficiently carry high service flows to north shore communities and will reduce the need for pumping from the Gillis Pump Station to the Northern High System. More than seven miles of new pipeline will be constructed as part of this project.

Project History and Background

The northeast corner of the Northern High Service System serves Marblehead, Swampscott, Nahant, Peabody, and Lynn. The existing pipelines are undersized for the current peak demand of the area. Upgrading the service entails furnishing and laying 37,750 linear feet of 48-, 36- and 24-inch ductile-iron or reinforced concrete and steel pipes, valves, and related appurtenances in Lynn.

Alternative routes have been investigated, and the final design for the selected route is underway, along with plans for handling the contaminated soil and groundwater.

The contaminated soil and groundwater will be addressed in accordance with DEP requirements. For this project a Utility Related Abatement Measure (URAM) will be the plan used by MWRA to address the contamination.

Scope

Subphase	Scope
Design 2/CS/RI	Design, construction services, and resident inspection of Construction Phases 2, 4, and 5.
Design /CS/RI	Design of the removal of contaminated soil, and preparation of alternative analyses for installation of a 900-linear foot pipeline on Summer St.
Construction 2	Construction of 6,600 linear feet of pipeline through Saugus.
Construction 3	Construction of a 900 foot section on a site on Summer St..
Construction 4	Construction of 5,000 linear feet of pipeline on Washington St..
Gas Main-Washington St.	Relocation of a gas main on Washington St..
Traffic System-Washington St.	Study for traffic control on Washington St..

Construction 5	Installation of 10,000 linear feet of pipeline on Western Avenue.
Technical Assistance	Technical assistance in the design and construction of the pipelines.

Northern High Service - Section 27 Improvements (692)

Purpose

To replace a segment of 98-year old pipe in Lynn which suffers from poor hydraulic performance and frequent leakage. Replacement with 7,600 linear feet of new pipeline will improve service to the communities north of Lynn.

Project History and Background

Section 27 is a 12- to 20-inch diameter cast iron main installed in 1898 which serves the communities north of Lynn. The main has become severely corroded through graphitization, a corrosion process which affects cast iron. As a result of this deterioration, nine major leaks have occurred since 1976, most of them in the last six years. Because the main runs under major thoroughfares in Lynn, repair of emergency leaks is disruptive and costly. Appropriate corrosion control methods will be employed on the new pipeline to minimize corrosion potential in Section 27. During preliminary design, an evaluation will be made to determine whether an adjacent pipeline, Section 35, should be rehabilitated concurrently.

Scope

Subphase	Scope
Borings-Section 27	Borings along the construction route to determine sub-surface conditions.
Construction - Section 27	Construction of 7,600 linear feet of pipeline to replace the existing severely corroded pipe.

Northern High Service-Revere and Malden Pipeline Improvements (693)

Purpose

To improve the delivering capabilities of major distribution lines serving the Northern High System. The existing pipelines are hydraulically inadequate and suffer from extensive corrosion and leakage. Replacement, rehabilitation and/or reinforcement with a new larger diameter pipeline, nearly four miles in length, will provide a strong and reliable means to convey water from the City Tunnel Extension to communities within the northern and eastern portion of the Northern High Service area.

Project History and Background

The southeast corner of the Northern High Service System has experienced pressure deficiencies due to undersized pipes and extensive pipeline corrosion. The corrosion problems have led to numerous leaks, and the pressure deficiencies cause firefighting difficulties. These deficiencies particularly affect Malden, Revere, Lynn, Winthrop, Deer Island, East Boston, Saugus, Nahant, Peabody, Marblehead, and Swampscott. To correct these problems, a series of pipeline improvements have been planned for the Northern High Service region.

A hydraulic study of the MWRA distribution system recommended that a new pipeline be installed in Revere, beginning at the Everett/Chelsea/Revere border and extending through Revere to the East Boston border.

This new pipeline runs parallel with existing pipelines and carries a large portion of the flow formerly carried by the existing system, thereby increasing water pressure and flow to Revere, East Boston, Winthrop, and Deer Island, particularly during periods of high demand.

Control valves were required to regulate water pressure and fill the Winthrop standpipe. The original control valves between Winthrop pipelines and the MWRA transmission mains were inadequate. Fluctuations in pressure threatened to rupture the town's pipelines. More efficient valves were required to eliminate the danger.

Flow tests performed on Sections 32 and 55 of the existing Revere and Winthrop pipeline revealed that these sections had severe flow problems. The pipeline was only able to carry a fraction of its designed capacity because of internal corrosion. Cleaning and lining the pipeline restored flow capacity.

Section 53 in Malden and Revere was an 18,900 foot long, 30-inch steel pipeline, exceeding 60 years of age. Workers dug four test pits to determine the condition of this pipeline and uncovered 18 holes in the pipe. Investigations into recent failures revealed severe corrosion through the pipe wall in

several separate locations. Replacement of the Malden portion of Section 53 with a new 48-inch main has been completed. The Revere portion of Section 53 will be rehabilitated and/or replaced as necessary to protect the integrity of the transmission system. Work will also include a study to determine the feasibility of abandoning Section 26. A possible new or rehabilitated pipeline from Section 53 in Revere north to Meter 125 in Saugus will be evaluated. In addition to feeding into the new 48-inch Saugus/Lynn pipeline, this pipeline will play an important role in the supply network for Deer Island. Section 53A, an old 24-inch pipeline, is used to connect Section 53 to Shaft 9A of the City Tunnel. It is undersized for this purpose and is a severe restriction. A new 3,000-foot, 60-inch diameter pipeline is needed to reinforce Section 53A. An 850-foot portion of Section 68 interconnects Section 53 with the new Saugus/Lynn pipeline. This section needs to be reinforced with 850 feet of 48-inch pipeline.

All of the work for this project, with the exception of the design and construction of Section 53, Revere Section 53A, and Section 68 is complete.

Scope

Subphase	Scope
Des/CS/RI-Revere/Malden	Design, construction services, and resident inspection for Section 53 in Malden and Section 97/97A in Revere.
Construction-Revere Beach	Installation of 5,491 linear feet of 36-inch pipeline and 10,111 linear feet of 30-inch pipeline on Section 97, as well as 3,872 linear feet of 24-inch pipeline, and 1,350 linear feet of 20-inch pipeline on Section 97A in the vicinity of Revere Beach Parkway.
Construction - Malden 53	Installation of 11,907 feet of 48-inch diameter pipeline in Malden on Section 53.
Landscaping	Payment to City of Malden for landscaping of traffic islands at the intersection of Route 60 and Eastern Ave.
Construction Assistance -Malden	Construction assistance for segment of Section 53 located in the Linden Square area of Malden.
Design-Revere Section 53 & Section 26	Design of Section 53 pipeline in Revere and possible replacement of portions of Section 26 between Section 53 and Meter 125 in Saugus.
Construction - Revere Section 53 & Section 26	Rehabilitation of 4,500 linear feet of 30-inch pipe in Revere on Section 53 and replacement of 1,500 linear feet under Route 1 in Revere. Also possible replacement of 5,825 linear feet of Section 26.
Easements	Easements negotiated along the construction route of Section 53 in Revere and Section 26.
Construction Assistance-Linden Square	Construction assistance for the segment of Section 53 located in the Linden Square area of Malden.

Construction - Linden Square	Construction of a 1,000 linear feet segment of Section 53 in the Linden Square area of Malden. The Massachusetts Highway Department has constructed this section as part of its roadway reconstruction around Linden Square.
Design/CA-Eastern Ave Rd. Restoration	Design of the full road restoration to ensure a stable road surface without cracking on Eastern Avenue in Malden.
Construction-Eastern Ave Rd. Restoration	Construction of the full road restoration to ensure a stable road surface without cracking on Eastern Avenue in Malden.
Construction Eastern Ave Sidewalk Restoration	Construction of sidewalks along Eastern Avenue in compliance with the requirements of the Massachusetts Architectural Access Board. This work will be done by the City of Malden.
Design-Control Valves	Design of the control valves needed to regulate water pressure and fill the Winthrop standpipe.
Construction-Control Valves	Construction of the control valves needed to regulate water pressure and fill the Winthrop standpipe.
Design-DI Pipe Cleaning and Lining	Design of the cleaning and lining of the 2,000 linear feet, eight-inch diameter water supply main to Deer Island.
Construction-Cleaning and Lining	Construction of the cleaning and lining of the 2,000 linear feet eight-inch diameter water supply main to Deer Island.
Design/CS/RI-53A & 68	Design, construction services, and resident inspection of two new connecting mains in Malden.
Construction-53A & 68	Construction of 850 linear feet of new 48-inch pipeline paralleling Section 68 which will connect Section 51 to Section 91 and 3,000 linear feet of new 60-inch pipeline (Section 53A) which will connect Shaft 9A to Section 53.
Design-Winthrop Cleaning and Lining	Design of the rehabilitation of Sections 32 and 55.
Construction-Winthrop Cleaning and Lining	Rehabilitation of 7,900 linear feet of 16-inch diameter pipe on Section 32 and 20-inch diameter pipe on Section 55 in Revere and Winthrop.
Technical Assistance	Technical assistance for all phases of construction.

Northern High Service-Pipeline Rehabilitation (724)

Purpose

To rehabilitate a number of small diameter distribution pipelines near the coastline from East Boston north to Lynn. All of these cast iron mains are unlined with C-Values below 70, and most are more than 60 years old. Improvements will primarily involve cleaning and lining and valve replacement.

Project History and Background

Pipeline Sections 33, 49, 54, 55, 56, and 69 in Malden, Everett, and Revere deliver water from the vicinity of Shaft 9A of the City Tunnel in Malden to the eastern and northern reaches of the Northern High Service System, including Everett, Revere, East Boston, Winthrop, Saugus, Nahant, Marblehead, and a portion of Lynn. The carrying capacity of these sections ranges from 50 to 60 percent of the original design capacity (C-Values: 61 to 73) because of a build up of rust deposits and other matter along the pipeline.

Scope

Subphase	Scope
Design/CA/RI	Design, construction administration, and resident inspection of the rehabilitation of Sections 33, 49, 54, 55, 56, and 69. Exploratory excavation and corrosion analysis will be performed during preliminary design to evaluate the structural integrity of the pipe, the condition of the bedding material, and the extent of pipe corrosion.
Appraisal/ Easement	Easements to be negotiated along the construction route.
Construction	Rehabilitation of 30,000 linear feet of 24-inch pipe on Sections 33, 49, 54, and 69, and 33,000 linear feet of 20-inch pipe on Sections 55 and 56. Rehabilitation is expected to consist primarily of cleaning and lining of the interior pipeline walls, as well as replacement of existing line valves, air/vacuum valves, and blow-off valves.

Northern Extra High Service-New Pipelines (708)

Purpose

To improve hydraulic service and reliability for major portions of the Northern Extra High System. Existing lines are undersized and frequently experience low pressure problems. Improvements will involve rehabilitation of two pipe segments and installation of a new parallel main into Waltham.

Project History and Background

Sections 45, 63, and 83 provide service to the Northern Extra High communities of Waltham, Lexington, and Bedford. The existing pipelines are not large enough to meet maximum day plus fire flow service goals. The community benefits realized by a new larger pipeline will include improved reliability, pressure, and flows, which will result in better fire protection and reduced pumping costs.

Scope

Subphase	Scope
Design/CA/RI	Design, construction administration, and resident inspection of two pipe phases.
Appraisal/ Easement	Easements to be negotiated along the construction route.
Regulatory Compliance	Disposal of contaminated soil.
Construction	Replacement of approximately 2,600 linear feet of Section 45 with 24-inch diameter pipe extending from the connection point at Meter 47 to Section 82 on Park St. at the intersection of Paul Revere Rd. in Arlington; installation of about 2,100 linear feet of new 24-inch pipeline, parallel to a portion of Section 83, starting from Meter 182 to the intersection of Waltham St. (in Lexington and part of Waltham) and Concord Ave. (in Lexington). Rehabilitation of Section 63, consisting of about 3,400 linear feet of 20-inch pipeline connecting Section 63 to Meter 136.

Hydraulic Model Update (725)

Purpose

This project includes reconfiguring the hydraulic model data files in order to utilize updated software and link the model to other databases.

Project History and Background

The MWRA Water System Model Study completed in 1990 by Camp, Dresser & McKee included the development of a computer based hydraulic model of the MWRA water system. The transmission and distribution systems, pump stations, storage tanks, revenue meters, pressure reducing valves, and other system appurtenances were incorporated into the model. The model was developed using software written by Stoner Associates, Inc. One of the main reasons for selecting Stoner was its ability to directly access databases on demand, Geographical Information Systems (GIS), and Supervisory Control and Data Acquisition Systems (SCADA).

In working towards an updated model staff have incorporated the capital improvements to the waterworks system, updated community demands based on Telog data, and changed the existing VAX/VMS operating system platform to a desktop PC environment to make the model more accessible to staff.

In addition to the recent improvements made to the computer hardware and software, current Stoner data files need to be updated and enhanced. Some of the enhancements in the Stoner application for Windows software include the ability to have a geographically accurate model, the ability to separate the whole system into individual service areas, model water quality, and efficiently update the system operational conditions through links to other maintained databases, including on-line modeling.

This project will include updating the hydraulic model to invoice geographic information accurately, and incorporate individual pressure zones, operational controls, links to the Chestnut Hill Operations Control Center, GIS databases, and in the future, the SCADA databases. The work will include calibrating the updated model by developing and coordinating a field testing to be performed by Distribution Section staff.

Scope

Subphase	Scope
Hydraulic Model Update	Software revision to the computer based hydraulic model of the MWRA's water system

Central Monitoring System (753)

Purpose

To provide a modern centralized system for monitoring, coordinating, and controlling critical waterworks functions. Many existing facilities are monitored and operated using obsolete methods and equipment, which can hinder emergency response capabilities and prevent coordinated system operation. An Operations Control Center is already operational, and various field facilities have been equipped with telemetry and communications equipment as part of this project.

Project History and Background

The Waterworks Division is planning to convert to system-wide remote monitoring and control of essentially all hydraulic and hydroelectric operations. The existing instrumentation used to measure operating parameters is incomplete, old, and in poor condition. In many cases necessary instrumentation does not exist. The current system also lacks telemetry to provide centralized and immediate information on system performance, and the ability to remotely intervene when malfunctions occur. Without telemetry, operating decisions are delayed until field personnel are dispatched to collect measurements. This is a cumbersome and undesirable mode of operation, particularly in emergency situations.

The lack of flow measurement within the water delivery system also impedes identification of sources of unmetered water. When fully implemented, the central monitoring system will generate instantaneous data on water flow and pressure in 18 subsystems beginning with the supply sources and ending at the delivery points to user communities. The data will assist operations staff in detecting and pinpointing leaks in the system. The response time for leak repair work can then be lessened, resulting in significant savings of water and reduction in potential MWRA liability for public safety and property damage.

The scope of the central monitoring project has grown from the initial automation of Reservoir Road Pumping Station to include the Gillis Pumping Station, the Lexington Street Pumping Station, and the Newton Street Pumping Station. Monitoring and control of water treatment facilities has expanded to include the Interim Corrosion Control Facility in Marlborough, the Interim Disinfection Facility at Cosgrove, the Norumbega Disinfection Facility, and the Weston Disinfection Facility. In addition, water quality is monitored at Shaft 9A, Commonwealth Avenue Pumping Station, and in the near future at two meter sites feeding Cambridge. Operation control centers in Chestnut Hill and in Southborough provide remote monitoring and control of all the SCADA facilities.

Scope

Subphase	Scope
Study	Study to determine the implementation phases.
Design	Design of the replacement and rehabilitation of 34 existing master meter sites, 22 new master meter sites, 15 western revenue meter sites, 28 reservoir level instrumentation sites, ten pumping stations, eight pressure regulator control sites, four major throttle valve sites, six chemical feed sites, four hydroelectric sites, five weather stations, five sluice gate control sites, one stream gaging station, and other facilities within the waterworks system.
Design - Operations Center	Design of a 5,000 square foot center including an environmentally controlled computer room, a printer room, a control room, office space, and sanitary facilities.
Construction Services	Construction services for operations control center, as well as metering and monitoring construction.
Communication Structures	Installation of two new radio towers, five antennas, one satellite dish, and an equipment shelter.
Construction 1: Reservoir Road and Cosgrove Pilots	Purchase of equipment to automate the Reservoir Road pumping station and an aqueduct monitoring system for use by the Cosgrove Intake and Shaft 4 operators. This work will be performed by in-house staff.
Construction 2: Metering and Monitoring	Purchase of Supervisory Control and Data Acquisition System (SCADA) equipment for monitoring and metering sites and pressure reducing valve sites. This work will be performed by in-house staff.
Construction - Operations Center	Construction of a 5,000 square foot center including an environmentally controlled computer room, a printer room, a control room, office space, and sanitary facilities.
Equipment Prepurchase	Purchase of instrumentation equipment, mechanical equipment, and new master meters.
Microwave Equipment	Purchase of services and equipment necessary to allow MWRA to convert from analog to digital communications to continue to utilize the Commonwealth's Interagency Microwave System.
Utility Installation	Connections of SCADA equipment to local utilities.
Technical Assistance	Technical assistance in the design and construction of the Operations Control Center and related equipment installation.

Rehabilitation of Existing Facilities (758)

Purpose

To repair and upgrade various field facilities by improving buildings, tanks, bridges, and grounds. Waterworks facilities are generally in deteriorated condition as a result of several decades of deferred maintenance and under-investment. Improvements include underground tank replacements, water tank inspection and rehabilitation, pipe and road bridge repairs, improvements required by life-safety and building codes, and miscellaneous equipment upgrades.

Project History and Background

Because of the advanced age of the Waterworks Division's facilities, major repairs are needed to restore existing buildings and other structures to proper operational condition. This project is an ongoing program to evaluate the condition of facilities, to identify priority improvements necessary for the safety and welfare of MWRA staff and to ensure operational reliability, and to systematically rehabilitate facilities in need of repair.

The Waterworks Division has a number of underground fuel tanks located at various facilities. U.S. EPA, DEP, and Department of Public Safety regulations require that all tanks be tested, that any defective tanks be replaced, and that any contaminated soil and water be remediated.

Scope

Subphase	Scope
Testing-Volumetric	Testing of fuel tanks to evaluate operational status
Design - Hyde Park Pump Station	Design of the rehabilitation of the Hyde Park Pump Station which houses 12 employees and is staffed 24 hours per day.
Construction - Hyde Park Pump Station	Rehabilitation included installation of new windows, doors, showers and locker room, rest rooms, an electrical power generator, a new roof, a new boiler, a new sound enclosure for a diesel pump engine, and electrical updating.
Subsurface Investigation	Environmental assessment of sites contaminated by leaking fuel tanks.
Design - Tank Removal Phase 1	Design for the removal of 22 out-of-service tanks from various locations.
Construction - Tank Removal Phase 1	Removal of 22 tanks from the following locations: construction field office in Stoneham, R. Lonergan Intake (Shaft 8) in South Barre, Mystic Shops in Somerville, Nash Hill Reservoir Service Building in Ludlow, Norumbega Reservoir and Weston Reservoir in Weston, Reservoir Road Pump Station in Brookline, Glenwood Yard in Medford, and Chestnut Hill Pipe Yard in Brighton. Cleanup of all contaminated soil and groundwater at these locations.

Design - Tank Removal Phase 2	Design for the removal of four out-of-service tanks from various locations.
Construction - Tank Removal Phase 2	Removal of four tanks from the following three locations: Glenwood Yard, Lake Cochituate in Natick, and Quabbin Aqueduct - Shaft 9 in Barre. Removal and disposal of all contaminated soil at these locations.
Design - Tank Removal Phase 3	Design of the removal of one tank at Shaft 8.
Construction - Tank Removal Phase 3	Removal of one tank at the R. Lonergan Intake (Shaft 8). Cleanup of soil and groundwater contamination at this location.
Design - Tank Replacement	Design for the removal of 11 existing underground storage tanks for the removal and replacement of various fuel tanks.
Construction - Tank Replacement	Replacement of 5 active service underground storage tanks and replacement of 3 above ground storage tanks with 2 new above ground tanks and remediation of any contaminated soil and/or water.
Design/CS/RI - Newton St. Bridge	Design, construction services, and resident inspection of a pipe bridge, which is a 30-inch pipe over two railroad right-of-ways, which has been in service for 60 years.
Construction - Newton Street Bridge	Replacement of the pipe over two railroad right-of-ways; insulation and covering for the pipe.
Water Tank Inspection	Inspection of the existing interior and exterior paint systems on five of the system's water tanks that have exceeded their useful lives.
Design/CS/RI - Water Tanks	Design, construction services, and resident inspection of structural repairs and repainting the interior and exterior of five water tanks.
Construction - Water Tanks	Structural repair, and repainting of the interior and exterior of five water tanks at the Arlington Heights Standpipe, Turkey Hill Tank, Bellevue Standpipe #1, Bellevue Standpipe #2, and the Walnut Hill Tank.
Design - Stony Brook	Design of the bridge, a 14-foot wide concrete arch spandrel structure spanning 30 feet.
Construction - Stony Brook	Dismantling and rebuilding approximately 100 feet of spandrel wall, replacing bridge railings, and installing an electrical ductbank. Rebuilding of the wall will require excavation adjacent to the bridge. A concrete line plug will be installed underground in preparation for the Sudbury valve replacement (Dam Control Valve Project #2202). This plug insertion will be completed as part of this project to avoid redundant excavation and potential undermining of the bridge structure.
Design/CS/RI - Mystic River Bridge	Design, construction services, and resident inspection of the rehabilitation of the bridge girders, pipe supports, and cross bracing which are corroded.

Construction - Mystic River Bridge	Rehabilitation of the Mystic River Bridge girders, pipe supports, and cross bracing. Rehabilitation consists of repairing, sand blasting, and painting the girders; installing new pipe joint clamps; installing a new wood deck; replacing the handrails; repointing the granite abutments; and installing a handicapped access ramp.
Facility Maintenance Equipment Purchase	Purchase of capital equipment and materials necessary to allow in-house crews to repair Waterworks facilities throughout the system during the winter months. Separate subphases are included for FY96 and FY97.
Facilities Maintenance Program	A comprehensive evaluation, prioritization, and repair and rehabilitation program designed to systematically implement capital improvements for all Waterworks facilities on a priority basis.
Construction-Waltham Pipe	Scope transferred to Shaft 7 to WASM 3 project.
Construction-Medford Pipe	Pipe work completed in 1993.

Distribution Systems Facility Mapping (763)

Purpose

To produce a complete, up-to-date set of appropriate scale maps of all underground Waterworks facilities, along with a comprehensive database inventory. Existing maps are outdated and unreliable, which complicates emergency response, field repairs, and planning.

Project History and Background

The Waterworks Division does not have an adequate, updated set of maps of all of its underground facilities. Existing maps do not consistently show current conditions and are often incompatible or contradictory with MWRA databases. Engineering, operations, and emergency response are all affected by this inadequacy. Outdated maps hamper engineering because maps must be re-created. Field operations crews cannot predict with certainty the results of valve shut-offs during repair efforts. The planning process is impaired because management does not have authoritative, consolidated data to evaluate pipe condition, age, C-Values, materials, and soil conditions. Additionally, the lack of a comprehensive understanding of the relationships between MWRA and local community pipe systems can result in service delays. The current mapping system creates the possibility of incorrect actions, and in critical instances could result in exacerbated property damage.

Scope

Subphase	Scope
Planning/Design	Creation of a complete set of 200 to 400 scale maps of the distribution system with an associated, verified inventory of size, material, age, and condition of pipes.
Data Purchase	Purchase of project related data from Boston Edison.

Local Water Infrastructure Rehabilitation Assistance Program (764)

Purpose

To provide financial support to MWRA Waterworks System communities to replace, rehabilitate, and maintain their waterworks system infrastructure.

Project History and Background

MWRA is committed to providing cost-effective, high quality water services that protect public health, promote environmental stewardship, and maintain customer confidence. Part of that mission is assisting member communities in providing high quality water. This project is designed to assist local communities in obtaining capital to replace and rehabilitate their waterworks system.

Objectives:

- To encourage communities to realize as much benefit as possible from the MWRA's planned waterworks capital program - the MetroWest Tunnel, covered storage, and the Walnut Hill Water Treatment Plant.
- To provide a financial mechanism to local communities to support local water infrastructure maintenance and rehabilitation.

Characteristics of the program:

- $30 million over two fiscal years: 75 percent interest-free loans, 25 percent grants
- Allocation based on communities' share of MWRA water charges.
- Repayment of the interest-free loans in five annual equal installments.
- No local match required.
- Guidelines for project eligibility developed by MWRA and the Advisory Board.

Scope

Subphase	Scope
Loans/Grants	Loans and grants for MWRA water communities to replace and rehabilitate their local water infrastructure.
Repayments	Repayment of the loans collected from participating MWRA water communities.

and Support

North Maintenance Facilities (930)

Purpose

To improve waterworks and sewerage staff operations by consolidating maintenance, operations, and equipment storage functions into a single new distribution facility serving the northern service area. This will relieve current maintenance operations overcrowding and adverse traffic impacts on neighborhoods abutting existing facilities.

Project History and Background

When the MWRA was created in 1986, 80 employees and 22 vehicles were transferred from the MDC to the MWRA to support maintenance of the metropolitan waterworks system and the northern sewerage system. Over the past 12 years, the Authority has invested in improved maintenance and repair of the systems. As a result, there are now 300 employees, 188 vehicles, and 50 pieces of heavy equipment devoted to maintenance activities in the north.

Despite the growth in personnel and equipment, MWRA has not upgraded its northern maintenance facilities, with the sole exception of leasing some temporary space. To facilitate an upgrade, the MWRA adopted the primary recommendation of the 1993 North Maintenance Facilities Plan. The plan calls for purchase of one new site to centralize Waterworks maintenance, and rehabilitation of two existing sites (Glenwood Yard and Mystic Shops) to house Sewerage maintenance crews. Upon completion of the planned work, the Authority will also be able to terminate its lease for temporary space at Linden St. in Somerville. Waterworks maintenance crews are currently located at four sites: Linden Street, Chestnut Hill, Mystic Shops, and Glenwood Yard.

MWRA received a recommendation from a member community and has adopted a development approach for a new facility by seeking a long-term lease for the site and have a developer build the facility to MWRA specifications. This will offset the loss of property taxation which has been an insurmountable problem for many potential host communities.

The plan calls for relocation of the trade shops at Mystic Shops and the MWRA's vehicle maintenance satellite facility at Linden Street to the new North Maintenance Facility (NMF) where most of the maintenance vehicles will be located. The Somerville Laboratory will also be relocated to the new site. Sewerage Division crews are currently located at Winchester Yard, Linden Street, Mystic Shops, and the Charlestown Pump Station. TRAC sampling staff will also move to the North Maintenance Facility. The North Maintenance Facilities Plan will result in the MWRA vacating all of the above mentioned facilities and portions of currently leased office space at the Charlestown Navy Yard. The plan is to surplus these facilities back to the Commonwealth of Massachusetts, consistent with the MWRA Enabling Act which governs disposition of property which no longer has

a waterworks or sewerage system use. The North Maintenance Facilities Plan will be completed in FY2001 and result in adequate housing of the maintenance crews and equipment for the next 50 years.

Scope

Subphase	Scope
Planning	Planning for new North Maintenance Facility.
Conceptual Design	Conceptual and schematic architectural programming and design services for development of RFP.
Developers Costs	Payment to developer for site acquisition and construction.
Design Review	Architectural review of proposals and verification of specifications.
Fitout	Costs of furnishings and equipment to fitout new facility.
Information/ Telecommunication Consultant	Consultant to implement plan for information and telecommunications systems at the new facility.
Existing Facility "Button Up"	Costs to close-out existing facilities and sites which will be abandoned by MWRA and declared surplus.
Moving Expense	Relocation costs of moving current operations at various sites to new facility.

Fore River Preservation (922)

Purpose

To maintain the integrity of the Fore River Staging Area (FRSA) located in Quincy for the support of the Boston Harbor Project and other MWRA activities while assessing disposition and development strategies and decisions.

Project History and Background

In October 1987, the MWRA purchased the General Dynamics Shipyard in Quincy for $49.5 million. The site was purchased to provide a material laydown and staging area for the construction on Deer Island and Nut Island. Additionally, the MWRA's residuals processing facility is located at the FRSA. Approximately 51 acres have been designated for use on various construction contracts, and seven acres are required for the residuals facilities. At one time, the MWRA leased approximately seven acres of surplus space to the Fore River Shipyard and Iron Works to operate a ship repair facility which is no longer in operation. In addition, approximately ten acres of space and one building at the northern end of the site have been leased by the United States Naval Shipbuilding Museum. In 1997, MWRA sold approximately 130 acres on the central and southern portions of the site to Masachusetts Heavy Industries for $10 million.

The MWRA is committed to prudent investment in this facility.

In order to maintain the integrity of the FRSA for harbor projects and other MWRA activities, 18 phases of repair or rehabilitation work have been completed. They include the replacement of cathodic protection systems, rehabilitation of Building #14, replacement of a water meter, repair of support equipment, and the installation of back-flow preventers and rectifiers. Three of the five dry dock gates at the FRSA suffered from extensive corrosion. Two of the dry dock gates were leaking, and the problem was kept in check through continual pumping. The installation of cathodic protection will prevent further deterioration of the dry dock gates, but is not sufficient to prevent eventual failure of the dry dock gate. Three elevators in the FRSA were repaired in order to meet state inspection and certification requirements. One of the repaired elevators is housed in the main office building, the second is required to make periodic inspections of a PCB transformer, and the third is in Building #4 and is required for material transportation. Buildings #15 and #16 at the FRSA were erected in 1917 and are badly deteriorated. A structural analysis of the buildings was performed and renovations were made in accordance with Massachusetts Historical Commission guidelines. The FRSA facility had six transformers which contained PCBs, which are considered hazardous substances. One transformer could not be used either by MWRA or any other potential user of the facility. Although the transformer was encased, it was possible that a leak could develop resulting in pollution to the Weymouth Fore River, which is 30 feet from the transformer. The transformer has

been removed and sent to a licensed disposal facility.

A 400,000 gallon water tank provides a water supply to the diesel booster pumps in the event of a significant fire. The tank is an integral part of the FRSA fire protection system. The water tank was drained several years ago because the low level of activity in the FRSA did not require this protection. With the increase in activity, the MWRA must reactivate the tank to increase its fire protection capability in order to maintain a favorable insurance rate. The fire alarm system at the FRSA was a slow response, antiquated system which was not compatible with the City of Quincy's system. The system was upgraded to current standards.

Core and soil samples are preserved because they provide information crucial to engineering and construction, and provide a physical record of the material in which pipelines and tunnels are situated. Storage capabilities were inadequate to preserve the samples, and the volume of samples requiring storage is expected to increase more than six fold due to the planned increase in capital projects. The second floor of Building #52 at the FRSA has been renovated to provide for adequate geological samples storage.

Many of the mechanical devices at the Fore River, such as elevators, cranes, and battery chargers, operate on direct current power. These devices are currently powered using the 2,100 horsepower generator. Since the vast majority of direct current devices will not be used during construction of the treatment plant, operating the powerful generator wastes energy. Furthermore, the direct current cables have developed insulation leaks which may accelerate corrosion in underground piping. The installation of rectifiers will permit more efficient use of power.

A survey of the steam pipe thermal system revealed that more than 15,000 linear feet of the pipe on the exterior of the FRSA buildings is covered with asbestos insulation. Although 10% of the material which fell to the ground had already been removed, the remainder of the material will continue to degrade, flake off, and fall to the ground, creating a serious health hazard to the work force in the area and significant potential liability for the MWRA.

Building #86 is a 52-year old, single story wooden building with a concrete floor and gravel roof. It is painted with lead based paint, contains asbestos insulation, and is in need of repair. The lead concentration of the paint is 33.6 times the acceptable limit. The chipping lead based paint has become a health hazard and must be removed. The building will not be used by the MWRA and estimated demolition costs are less than estimated repair costs.

A small segment of railroad track on the branchline in Braintree near the Conrail merge is a potential hazard. Should a buried trestle deteriorate, train loads would be transferred to an embankment of unstable soil. Therefore, improvements must be made to the embankment to enable it to support these additional loads.

Building #19 is a 28,500 square foot, two-story building which currently does not meet minimum

safety standards and is energy inefficient. The building is needed to eliminate overcrowding and substandard working conditions for South System Sewerage Division staff from the Transport Department, and the South Maintenance Yard. The facility will also include space for a carpentry and welding shop and will house one vactor jet truck and one sewer jet truck, as well as construction equipment and vehicles. The sewer jet trucks must be garaged because they are not designed to withstand sub-freezing temperatures. The purpose of the FRSA Upland Phase II contract is to prepare these buildings for long-term storage and warehousing use for Deer Island and other MWRA facilities.

The decision to use Building #1 for centralized warehousing and Deer Island spare parts storage has allowed a substantial reduction in the size of the dry storage building planned for Deer Island. Renovations to Building 4 will enable the MWRA to consolidate all of the Authority's records into a central Records Center (including the core borings) while vacating the buildings in the proposed sale area. Design for all improvements have been completed in-house or through technical assistance consultants. The Support Services Division is responsible for all phases of this project except the rehabilitation of Building #19 and the embankment improvements, which are the responsibility of the Sewerage Division.

Scope

Subphase	Scope
Cathodic Protection	Cathodic protection of three drydock gates.
Repair Elevators	Repair three elevators; decommission all others.
Rehab Bldgs 15 & 16	Rehabilitation included renewal of the roofs, repairs to the brick and mortar, window and door repair and replacement, and renovation of existing walls.
Rehab Bldg 14	Refurbish first floor.
FRSA Water Meter	Replacement of one water meter.
FRSA Repair Equip.	Repair, clean, calibrate, and service support equipment.
Back-flow Preventers	Installation of back-flow preventers.
PCB Transformer	Remove and send one transformer containing Polychlorinated Biphenyls (PCB) to a licensed disposal facility .
Water Tank Constr.	Install an electric heating system, corrosion protection, and insulation to reactivate a 400,000 gallon water tank.
Fire Alarm Upgrade	Installation of 10,000 linear feet of new cable from Quincy Fire Department Headquarters to the FRSA and replacement of wiring and retrofitting of 35 pull boxes.

Geological Storage	Renovation of the second floor of Building 52, including replacement of windows and doors, installation of insulation, sheet rock, fire sprinklers, fluorescent fixtures, and a seven kilowatt heater.
Install Rectifier	Installation of rectifiers to eliminate reliance on DC power system.
Asbestos Removal	Removal and disposal of 13,500 linear feet of exterior asbestos pipe insulation.
Demolition - 86	Demolish Building 86.
Embankment Improvements	Repairs consist of adding sidehill fill to areas along an embankment of unstable soil.
Building 19 Rehab	Rehabilitation consists of cleaning and demolition; replacement of energy-inefficient doors and windows; electrical system improvements; and installation of new HVAC, plumbing, and fire protection systems, interior partitions, floor coverings, ceilings, and a new interior staircase. Also includes purchase of a backhoe for the Transport Department.
ESDC - Bldg 19	Engineering services to support Building 19 rehabilitation work.
Tech Asst - Bldg 19	Technical assistance to support Building 19 rehabilitation.
Geological Shelving	Industrial strength shelving required to store core samples in the newly renovated records storage area.
FRSA Upland Phase II	This contract will complete the rehabilitation of Buildings #1 and #4, including interior build-out of storage and office facilities as well as reconstruction of substation #1, which is needed to provide reliable power to these and other FRSA buildings.
Dry Dock Pumps	The purchase of pumps required to de-water the dry docks.
Equipment Inspection	The purchase of a TV inspection truck required to conduct internal infrastructure inspection.
Hazardous Waste	Transferred phase from Wastewater.

Technical Assistance (925)

Purpose

To ensure ready access, on an as needed basis, to professional and technical services not available or not cost-effectively provided by in-house staff.

Project History and Background

Efficient implementation of the MWRA's Capital Improvement Program often requires specialized skills and technical assistance which are not available from in-house staff. This project ensures ready access to a variety of skills on an as- needed basis through a series of task order contracts with pre-set limits. A division director can request a task order when immediate expertise on capital projects is required. This project budget includes funds for actual and projected use of technical assistance.

Scope

Subphase	Scope
Technical Assistance	Technical assistance contracts include the following engineering and other skills: sanitary, electrical/HVAC, mechanical, structural, materials testing, environmental testing, geotechnical, surveying, hazardous materials assessment, asbestos assessment and design, architecture/landscaping, instrumentation/control, wetland/environmental, civil engineering, land appraisal, cost estimating, and energy.

Business Systems Plan (931)

Purpose

To adapt to the changing business needs of planning and managing the waterworks and sewerage systems, the MWRA initiated a business system planning effort to develop and procure management information systems (MIS) in support of business functions.

Project History and Background

During the budget development process for the FY94-96 Capital Improvement Program, it became clear that future capital investments would be required to upgrade, enhance, and potentially expand the MWRA management information systems (MIS) in order to adapt to the changing business needs of planning and managing the waterworks and sewerage systems, and to respond to new regulatory requirements. In order to address these needs, the MWRA initiated a business systems planning effort to determine its future MIS support requirements. Because of rapidly changing technology and limits on the MWRA's ability to forecast long-term MIS needs, the decision was made to have the initial business systems plan focus primarily on the FY95-97 period (Phase 1), with updates occurring every year thereafter. The MWRA anticipates that publication and annual updates of the plan will assist staff, external constituencies, and the Board of Directors in understanding the critical role of information systems in carrying out the MWRA's environmental and economic mission. In addition, the plan provides comprehensive documentation for future resource requirements. In January 1993, work group sessions led by a planning support team of MIS and Rates and Budget Department staff were conducted with the Sewerage and Waterworks Divisions. The plan incorporated maximum reuse of existing assets and captures economies through shared databases, applications, and hardware. In early 1996, Phase II (FY97-99) was introduced to the Board of Directors. This phase builds on the progress made during Phase I and continues to consolidate the work of MWRA information systems. Phase II continues to develop economies of scale through optimization of existing assets, technology conversion promoting database integration, and infrastructure improvement. The objective of Phase II is to increase staff productivity and seek cost savings where applicable. The proposed changes complement the MWRA Business Planning efforts currently underway. Phase III (FY99-01) will further enhance MWRA-wide work process improvements.

With the advent of the Year 2000, MWRA's systems and applications must be assessed and corrected to avoid system failures caused by the inability of systems to recognize the change in the millennium. Phase IV has been added to the BSP for this purpose.

In addition, Phase V (FY01-03), has been added to budget for MWRA's continuing program of improvements.

Scope

Subphase	Scope
Phase I (FY95-97)	Hardware: Upgrade Boston Harbor Project technical minicomputers; purchase a Unix based minicomputer for GIS integration and consolidation and work stations for high-end modeling (SAMS) and mapping functions; upgrade/replace PCS; improve storage requirements for the TRAC IS and wastewater flow data; and lease three replacement minicomputers for administration and finance systems to address capacity and performance issues. Software: Implement and enhance the Sewerage Analysis and Management System (SAMS) to incorporate improved hydraulic modeling capabilities, condition information, mapping, and GIS data so that CSO Master Plan and Transport data requirements are met. Upgrades and enhancements to the TRAC/IS to address improved enforcement, monitoring, permitting, and integration of information with other systems. Upgrade the GIS application to the industry standard to allow more integration and analysis of data.
Phase I (FY95-97) continued...	Implementation of CADD software and related tools including the establishment of a document management system to index thousands of engineering documents maintained by the Records Management Center and Sewerage Technical Information Centers at both CNY and Deer Island. Network: Replacement of obsolete software used for access to administration, finance, and technical minicomputer applications. Develop a network plan for future BSP updates that address industry changes, maintenance/replacement concerns, and functionality needs.
Phase II (FY97-99)	Phase II consists of eight elements key to the continued productivity of MWRA staff. The eight elements are: (1) server consolidation, (2) network scalability program, (3) database integration program, (4) PBX replacement, (5) electronic records program, (6) procurement replacement, (7) maintenance management, and (8) waterworks programming services. Server consolidation: Improvement of the storage capacity, availability and manageability of the servers used by MWRA staff. This includes consolidating the 30 individual, independent file servers to approximately five, while avoiding the cost of hiring several server administrative staff to manage the resources. Network scalability program: Improvement of the data network by increasing the data access and retrieval to meet current and projected demand over the next several years. Database integration program: Standardize the programming/database environment between portfolios by converting to Oracle-based systems (the standard for water and sewer systems) and consolidating/integrating data across the organization. Thus providing improved reporting and programming resource management at overall lower cost by avoiding large increases in positions.
Phase II (FY97-99) continued...	PBX replacement: Replacement of the current Siemens Private Branch exchange (PBX) switches at the Charlestown Navy Yard with equipment that has a projected useful life of 10 years. Neither the PBX system or replacement parts are currently manufactured resulting in high risk of extended and/or complete system failure.

	Electronic records program: Establishment of computing resources, procedures, and training necessary to satisfy audit and good practice requirements for security and file management; and expected federal/state regulations regarding electronic public records.
Phase II (FY97-99) continued...	Procurement replacement: Replacement of the existing software (Purchase Stores Inventory or PSI) that is obsolete and will not be upgraded/updated by the vendor. Maintenance management: Automated maintenance software and corresponding hardware to replace obsolete Hewlett Packard maintenance software where it is currently used, and to provide systems support for areas currently using manual tracking methods. Waterworks programming services: Programming services to meet the requirements of water quality testing as a result of the water quality work process improvements being conducted as part of the business planning process.
Phase III (FY99-01)	Procurement of new General Ledger/Accounts Payable/Procurement/Budgeting system, network support, and legal audit.
Building 36 Generator	Purchase and installation of a back-up generator for Building 36 in the Charlestown Navy Yard.
Phase IV	Year 2000 assessment and improvements.
Phase V (FY01-03)	To be determined.

Capital Budget Contingency

Purpose

There are certain costs associated with the Capital Improvement Program that are not possible to predict with any degree of certainty. These costs include legal fees, settlement of claims, acquisition of land, and a variety of study, design, and construction change orders and contract amendments. A capital budget contingency is needed to authorize the expenditure of funds to cover these costs. The amount necessary for the contingency is calculated using the methodology described below. At the end of each fiscal year, any remaining funds in the contingencies lapse and new contingencies are created based on the new fiscal year budgets for the projects.

Boston Harbor Project

For non-tunnel Boston Harbor related projects the contingency is 10% of annual expenditures. The contingency for tunnel construction is 15% of annual expenditures because of the greater risks of tunnel construction. The BHP contingency fund is monitored and reported separately, and no transfers between the contingency funds are permitted.

BHP Claims Contingency

The Board of Directors approved a separate $31 million contingency fund established specifically for claims associated with the Effluent Outfall Tunnel and other BHP contracts.

Other Projects

A separate contingency fund, the "Other Projects " contingency fund, provides the contingency for all non-BHP projects and is calculated as 10% of the annual expenditures for all other Wastewater, Waterworks, and Business Operations and Support capital projects. The MetroWest Tunnel project utilizes the Other Capital Projects contingency fund. The total contingency amount calculated for the MetroWest Tunnel project is 15% for all tunnel contracts and 10% for all other phases. No contingency is budgeted for CSO community-managed contracts, the Holden/West Boylston sewer project, technical assistance contracts, land acquisition, and community MOUs.

APPENDIX A

EXPECTED USEFUL LIFE OF CAPITAL PROJECTS

The estimated useful lives of MWRA's capital projects are summarized below:

Type of Capital Improvement	Estimated Useful Life (in years)
Study	5
Equipment	15
Cathodic Protection	15
Water Pump Station (rehab)	40
Sewer Pump Station	40
Water Treatment Facility	40-50
Wastewater Treatment Facility	40-50
Stop Planks	40
Control Valves	40
Sewer Pipeline (new)	50
Sewer Pipeline (rehab)	50
Covered Storage Facility	60
Water Pipeline (steel)	60
Water Pipeline (concrete)	100
Water Pipeline (steel and cathodic protection)	100
Deep Rock Tunnel	100

These useful life estimates are currently under review for MWRA by a consulting engineer.

APPENDIX B

CAPITAL IMPROVEMENT PROGRAM DEVELOPMENT

Schedule and Process

MWRA is required to produce periodic revisions to its Capital Improvement Program (CIP) Budget. Development of the budget occurs in two cycles, first in proposed form, second in final form.

The first cycle entails review of existing capital projects and consideration of new project proposals. The cycle lasts from July to December and results in the proposed capital budget. MWRA is then directed by the Board of Directors to transmit the budget to the Advisory Board for a 60-day comprehensive review of the document. At the end of the review process, the Advisory Board submits formal comments and recommendations to the MWRA.

The second cycle, preparation of the final budget, begins in March. Upon completion of Advisory Board review, the divisions update project schedules, budgets, and expenditure forecasts for any new information which has become available since the proposed budget. During the month of May, a special committee of the Board of Directors holds a hearing on the proposed budget. The final document is prepared and submitted to the Board of Directors for final approval at the end of June. Upon approval, the budget becomes effective July 1st and remains in effect for one year.

A more detailed listing of CIP activities follows.

Developing the Capital Budget - Calendar of Activities

Month	Task
June	Rates and Budget Department distributes proposed budget forms, instructions, and diskettes to divisions.
July	Divisions submit new project proposals (Form 1s).
August	Divisions submit proposed budgets and expenditure forecasts to the Rates and Budget Department.
September	Rates and Budget Department meets with division staff to resolve new and expanded project issues.
	Rates and Budget Department prepares proposed budget comments and recommendations.

October	Executive Director reviews the projects and makes decisions.
	Rates and Budget Department (CIP & CEB) reviews updated Current Expense Budget impact sections.
	Rates and Budget Department and divisions finalize expenditure forecasts and schedules.
November	Analysts prepare revenue, grant, and debt service estimates.
	Divisions review draft project narratives.
December	Rates and Budget Department prepares proposed budget document.
	Rates and Budget Department submits proposed budget document to the Board of Directors for official transmittal to the Advisory Board.
January - February	Advisory Board reviews proposed budget.
	Rates and Budget Department staff, with assistance from divisions, respond to the Advisory Board's questions about proposed budget.
March	Advisory Board submits comments and recommendations to MWRA.
	Rates and Budget Department reviews the Advisory Board's recommendations with divisions to develop MWRA's response and to discuss possible budget changes.
	Rates and Budget Department distributes final budget forms, instructions, and diskettes to divisions for CIP update.
April-May	Board of Directors conduct hearings on proposed budget.
	Rates and Budget Department, with assistance from Divisions, develops MWRA's final response to the Advisory Board's recommendations.
	Divisions incorporate final recommendations into CIP update.
	Divisions return completed forms and diskettes for the CIP update.
June	Board of Directors review and approve MWRA's formal response to the Advisory Board's recommendations on proposed budget.

MWRA distributes official response to the Advisory Board's comments and recommendations.

Board of Directors review and approve final budget document.

B. Proposed CIP Preparation

Each division is required to submit proposals for each existing capital project, new capital projects, and equipment requests to be considered for inclusion in the proposed Capital Improvement Program. Proposals for new capital projects are considered once a year during the preparation of the proposed CIP. The only exception to this rule is acceptance of a new project proposal that requires a commitment of resources during that fiscal year.

There are four major goals to be met to ensure that the budget document is accurate. The first goal involves writing a narrative section which describes and justifies the project and articulates the public benefit derived from the proposed capital investment. In general, this goal has been met for existing projects. However, the project descriptions must be continually updated to include any changes in project scope.

The second goal consists of a continuing effort to improve project schedules. Project planning involves developing data on individual milestones and tasks required to carry out each project phase, and should also identify the staff resources necessary to carry out each task. Detailed project planning will not only be used to establish project schedules, but will also permit quarterly variance reporting of actual performance in comparison to planned progress for each capital project.

The third goal is to develop accurate cost estimates in current dollars for all phases with particular attention given to large construction phases. New cost estimates should be obtained from the consultant at regular intervals during the design process. These estimates will be incorporated into the budget document. In order to ensure the accuracy of in-house and consultant cost projections, detailed cost estimates should be supplied to the Rates and Budget Department in support of the budget amount.

The fourth goal involves the continuing effort to improve the accuracy of capital expenditure projections. Every effort should be made to project the probable sequence of construction tasks, and make allowances for winter construction. In addition, project managers should request the contractor's cashflow and use this in drafting the expenditure projections for awarded contracts.

The CIP update process also has secondary goals which include comprehensive identification of all phases of a capital project that will result in a contract, greater accuracy in the estimation of operations and maintenance costs for new capital facilities, and greater precision in predicting grant revenue.

CAPITAL BUDGETING POLICIES AND PROCEDURES

These policies and procedures govern capital budgeting and management practices at the Massachusetts Water Resources Authority. Deviations from policy, if any, will be reported to the MWRA's Board of Directors. Policies and procedures may be amended from time to time, provided that changes in provisions governing reporting to or approvals by the Board of Directors or the Advisory Board must be approved by the Board of Directors.

CAPITALIZATION POLICY

It is the policy of the MWRA that capitalization of expenditures be in conformance with generally accepted accounting principles. Under such guidelines, the MWRA has adopted the provision of the Financial Accounting Standards Board's Statement No. 71, "Accounting for the Effects of Certain Types of Regulation," to provide a better matching of revenues and expenses. Capital expenditures are intended to create assets or extend their useful lives. Assets are valued at their cost and provide benefits over an extended period of time. Sources of funds for capital expenditures include grants and loans, proceeds of MWRA borrowing, and current revenue.

Asset value created by the MWRA is of two kinds. One is the value of tangible assets either created or increased through MWRA capital investments. Such assets include land, buildings, plant, equipment, and the system infrastructure for water and wastewater. The cost of such fixed asset investment includes not only purchase, rehabilitation, or construction cost, but also ancillary expenses necessary to make productive use of the asset. Ancillary costs can include, but are not limited to, costs for planning studies, professional fees, transportation charges, site preparation expenditures, and legal fees and claims directly attributable to the asset.

The second kind of asset value created by MWRA investment is the value of intangible assets. While such investment does not result in tangible MWRA assets, it does create a benefit to the MWRA and its users over several years. Such assets include the cost of MWRA efforts to establish base-line leak detection information for the water systems of MWRA customers. The cost of providing water consumption-limiting devices to households is another example.

Expenditures for tangible assets are included in the Capital Improvement Program and Budget if the expected cost of the individual asset or capital project is $100,000 or more and if the expected useful life is more than one year. Expenditures for intangible assets are capitalized if the expected benefit period is three years or more. Annually recurring costs and expenditures for maintenance of assets are not capitalized, even though their cost may exceed $100,000. Such recurring and maintenance costs include replacement of vehicles and computers, replacement of valves, and repair of interceptors and pipelines.

Renewal and Replacement Reserve

The renewal and replacement reserve has been established to fund a required capital improvement which is not provided for by monies otherwise available. Amounts may not be withdrawn until MWRA has specified the project to which the amount will be applied and its estimated cost and estimated completion date. It must also certify that such expenditure is reasonably required for the continued operation of the systems or for maintenance of revenues and that other provisions have not been made for funding such expenditures. Every three years, MWRA will receive recommendations from a consulting engineer as to the adequacy of the renewal and replacement reserve fund requirement.

CAPITAL BUDGET MANAGEMENT POLICIES AND PROCEDURES

Capital Budget Contingency

A contingency for each fiscal year is incorporated into the Capital Improvement Program for the purpose of providing funds for unanticipated or unpredictable costs associated with capital projects. Transfers from the contingency budget to the budget for a capital project phase can be made at any time during the fiscal year. Such transfers will occur automatically when the Executive Director authorizes either a contract award amount higher than the budgeted figure for the project phase, or change orders/contract amendments that result in costs higher than budgeted expenditures. If the contingency for the fiscal year has been exhausted, a budget amendment authorized by the Board of Directors is required to replenish it. A report on current and cumulative transfers from the contingency budget will be prepared monthly by the Rates and Budget Department.

Capital Budget Amendment

From time to time, it may be necessary to amend the Capital Expenditure Budget. Amendments are required when an unbudgeted capital project is proposed; a capital project budget, including all contingency transfers, has been exhausted by contract awards; or the contingency is to be replenished. In such cases, the Executive Director may recommend to the Board of Directors a budget amendment which can include new or higher amounts for individual projects or an additional contingency amount. The amendment will be submitted to the MWRA Advisory Board for review and comment for a period of 30 days. At the end of the 30 day period, the Board of Directors may take action on the budget amendment.

Capital Budget Monitoring and Reporting

The progress of capital projects is continually monitored for purposes of managerial control and decision-making and for financial planning and management. Each division is responsible for monitoring and reporting on the projects for which it is responsible, including explanations for

both schedule and expenditure variances. Monitoring of revenue variances is a joint responsibility of grants management and budget staff. Monthly expenditure reports are distributed to divisions by the Rates and Budget Department.

Reports to the Executive Director on capital budget performance will be made quarterly. Two capital budget variance analysis reports will be provided to the Board of Directors, one for the first six months of a year and one at year end. The reports will include planned project schedules, revenues, and expenditures compared to actual performance. A schedule variance occurs when actual project schedules are three or more months behind or ahead of the planned timetable.

APPENDIX C

GLOSSARY OF TERMS

Activated Sludge - the sludge that results when primary effluent is mixed with bacteria-laden sludge and then agitated and aerated to promote biological treatment.

Advanced Waste Treatment - wastewater treatment beyond the secondary or biological stage that includes the removal of nutrients such as phosphorus and nitrogen and the removal of a higher percentage of suspended solids and organic matter.

Aerobic - in the presence of oxygen.

Anaerobic - life or processes that require, or are not destroyed by, the absence of oxygen such as bacteria which digest sludge.

AOC - Assimilable Organic Carbon - One measure of the "food" available to bacteria within a water system. More complex carbon compounds can become assimilable when oxidized by strong disinfectants

Ash - the inert material remaining after the combustion of wastewater sludge. It can be either wet or dry depending on combustion system design.

Bacteria - one-celled microscopic organisms commonly found in the soil that perform a variety of biological treatment processes.

BDOC - Biologically Degradable Organic Carbon - another, more precise, measure of the "food" available to bacteria within a water system.

Biofilm - growth of various bacteria within the distribution systems on the pipe walls. Can contribute to iron corrosion, colored water, taste, excessive chlorine demand and complications with coliform testing.

Blow-off Valves - valves operated during pipeline repair to dewater and isolate a portion of the pipeline.

BOD (Biochemical Oxygen Demand) - an indicator of the amount of biodegradable contaminants in wastewater.

BWSC (Boston Water and Sewer Commission) - responsible for providing water and sewer services to the City of Boston.

CAC - Citizens Advisory Committee.

CADD - computer aided drafting/design

Capital Investment - development of a facility or other asset which adds to the long-term value of an organization.

Cathodic Protection - a form of corrosion protection which is particularly effective against galvanic corrosion. Galvanic corrosion occurs when pipe metal is in the presence of other metals while immersed in water. The interaction of these elements causes an electric current to flow away from the pipe, taking electrons with it and pitting the pipe as a result. Cathodic protection reverses the current thereby stopping the corrosion.

Centrifuge - machine that uses centrifugal force to separate substances of different densities and remove moisture.

Chloramination - process of adding chloramine to drinking water. Chloramine is a long lasting residual disinfectant created by combining measured amounts of chlorine and ammonia. It forms fewer DBPs than chlorine.

Chlorine - a relative strong primary disinfectant, effective against *giardia* and viruses, but not *crypto sporidium.* Concerns exist about the health effects of its byproducts, some of which are or will be regulated.

CFM - (Cubic Feet per Minute) - a measure of the quantity of a liquid flowing through a pipe.

$ClNH_3$ - chemical symbol for chloramine.

Clean Water Act of 1972 - passed by Congress to protect the water resources of the nation, promote cleanup efforts of polluted bodies of water, and encourage states to adopt water conservation measures. It also prohibits many environmentally unsound disposal methods that threaten to pollute the nation's water supplies.

Cl_2 - chemical symbol for chlorine

Cleaning and Lining - cleaning and cement lining of unlined cast iron mains to improve hydraulic capacity and increase useful life.

Coliform Bacteria - a group of lactose fermenting bacteria, which while not of direct health concern, are used as a first line indicator of potential contamination. See fecal coliform and *E.coli.*

Combustion - the process of burning wastewater treatment residuals to remove water and reduce the remaining residues to a safe, nonburnable ash.

Comminutor - a machine or process which pulverizes and reduces solids to minute particles.

Composting - the process of converting wastewater treatment residuals to a soil-like humus material often used in the horticultural industry. The process involves the aerobic breakdown of the residuals and the addition of sawdust or wood chips.

Corrosion Control - adjustments to the chemistry of the treated water to reduce its ability to dissolve lead, copper or other metals. Can involve adjustments to pH, alkalinity and the addition of corrosion inhibitors, such as phosphates.

Cross-Connection - a point at which potable water piping is connected to a non-potable water source creating an opportunity for introduction of pollutants into the potable water.

Cryptosporidium - a protozoan parasite, which can cause severe gastrointestinal (GI) disease in healthy individuals, and may be fatal to the immuno-compromised. It exists in the environment as a hard walled oocyst, and is very resistant to disinfection.

CSO (Combined Sewer Overflow) - combined sewers in the metropolitan Boston area collect both sewage and storm water runoff for wastewater treatment. During rainstorms, the system becomes overloaded and the excess is discharged directly into Boston Harbor from Combined Sewer Overflow pipes. There are approximately 88 CSOs that discharge into the harbor.

CT - a measure of disinfection effectiveness established under the SWTR: the product of the concentration of disinfectant [C] times the time it has been in contact with the water [T]. It varies by organism, temperature and pH.

Current Expense Budget Impact - the affect a project will have, upon completion and activation, on the current expense budget of the MWRA.

C-Value - the carrying capacity of a water main for a specified length and pressure drop is determined by its diameter and resistance to flow. The friction coefficient "C" of the main is often used as a measure of flow resistance. C-values for new pipe are about 120 for mains 6- to 16-inches in diameter, and 130 and 140 for larger diameters.

DAF - Dissolved Air Flotation - a process of adding super saturated air into water to cause coagulated solids to rise to the top and be skimmed off. It replaces conventional gravity sedimentation (clarification) and is particularly cost-effective for low turbidity waters with periodic algal blooms.

DBP - Disinfection By Products - complex compounds formed by the use of oxidizing agents such as chlorine or ozone in waters containing organic matter.

DEP (Department of Environmental Protection) - the Massachusetts agency that regulates water pollution control, water supplies, and waterways and dispenses federal and state grant funds to support these activities.

Dewatering - the process of removing water from wastewater treatment residuals. Dewatered sludge has the appearance of a mud or wet soil material.

Diffusers - a system of shafts, rising from the end of the effluent outfall tunnel to the seabed, that will disperse treated wastewater over a large area.

DIFP (Deer Island Facilities Plan) - the MWRA's plan to construct new facilities on Deer Island and to provide secondary treatment of wastewater generated by the 43 communities in the MWRA sewer area.

Digesters - tanks for the storage and anaerobic or aerobic decomposition of organic matter present in sludge.

Disinfection, Primary - the inactivation (killing) of pathogenic organisms by the use of chemical or other disinfection agents.

Disinfection, Residual - the presence of a measurable residual of disinfectant within the distribution system to help control bacterial regrowth and guard against contamination within the system.

Dissolved Oxygen (DO) - a measure of the amount of oxygen in a given amount of water. Adequate levels of DO are needed to support aquatic life. Low dissolved oxygen concentrations can result from inadequate waste treatment.

D/DBP Stage 2 - Disinfectants/Disinfection Byproducts, Stage 2 Rule - 5/2002. This rule is expected to further reduce the amount of DBPs allowed in water. Place holder values of 40 ppb for TTHMs and 30 for HAAs were established through the regulatory negotiation process in 1994. Final values are expected to be set through the reg-neg process and based on new health data on DBPs and microbial threats

D/DBP Stage 1 - Disinfectants/Disinfection Byproducts, Stage 1 Rule - 11/1998. This rule is expected to set DBP limits at 80 ppb for TTHMs and 60 ppb for HAAs.

Dual Host Computer - coupled computer system consisting of two computer processing units (CPUs), one CPU running the main system and the second CPU providing back-up protection as well as running low level activities.

E Coli - a normal inhabitant of the digestive tract of mammals. Presence of *E. Coli* indicates probable contamination by fecal matter.

Effluent - treated wastewater discharged from a treatment plant.

EIR (Environmental Impact Report) - state process to review environmental impact and ensure public review.

EIS (Environmental Impact Statement) - Federal review process.

ENF (Environmental Notification Form) - the first step in the EIR process.

EOEA (Executive Office of Environmental Affairs) - the Massachusetts cabinet office overseeing all state environment agencies.

EPA (Environmental Protection Agency) - the federal government agency responsible for environmental enforcement and investigation.

ESTWR - Enhanced Surface Water Treatment Rule - 11/ 2000 & 5/2002. These rules are expected to tighten the standards for the operation of filtration plants and add requirements for control of *crypto sporidium.* The concept of proportional treatment, with cleaner sources required to provide less treatment, is being considered.

Eutrophication - nutrient enrichment of a lake or other water body, typically characterized by increased growth of planktonic algae and rooted plants. It can be accelerated by wastewater discharges and polluted runoff.

Fecal coliform bacteria - a group of bacteria used as a primary indicator organism for potential contamination from human or animal waste. Specific organisms in the group may or may not be of health concern.

Filtration - water treatment process involving the removal of suspended particulate matter by passing the water through a porous medium such as sand or carbon.

Flash coat - a light coat of shotcrete used to cover minor blemishes on a concrete surface.

Force Main - a pressure pipe joining the pump discharge at a water or wastewater pumping station with a point of gravity flow.

Giardia - a protozoan parasite, which can cause severe gastrointestinal (GI) disease, although there is medical treatment available. It exists in the environment as a hard walled cyst, and is resistant to disinfection. It is the most difficult of the currently regulated microbial contaminates to inactivate.

Graphitization - corrosion mechanism which alters the molecular structure of the carbon/iron matrix of cast iron pipe. During the process, iron atoms are forced away from the metal leaving behind an unstable carbon matrix. The result is a weakened pipe, easily susceptible to ruptures. High frequency in the number of breaks has caused leakage to be a major problem of graphitized pipe.

Grit - sand-like materials that quickly settle out of wastewater.

Groundwater - the body of water beneath the surface of the ground. It is made up primarily of water that has seeped down from the surface.

HAA - Haloacetic Acids - a class of disinfection byproducts, primarily of chlorine. Proposed for regulation under the D/DBP Rule.

Head House - a structure containing the control gates to a conduit such as a sewer pipeline.

Headworks - a preliminary treatment device or structure, usually involving a screening and degritting operation, that removes large or heavy materials (such as logs and sand) from wastewater prior to primary treatment.

Heavy Metals - metals that can be precipitated by hydrogen sulfide in acid solution, for example, lead, silver, gold mercury, bismuth, and copper.

IESWTR - Interim Enhanced Surface Water Treatment Rule - 11/1998. This interim rule for large systems is expected to require more stringent operating parameters for systems which filter and to add an MCLG for crypto sporidium.

Incineration - see combustion.

Infiltration/Inflow - the means by which groundwater and surface water enters sewer pipes and results in treatment of unnecessarily large wastewater volumes. Infiltration is groundwater that leaks into the sewerage system through pipe joints and defects. Inflow is primarily a wet-weather phenomenon and refers to water that enters sanitary sewers from improperly connected catch basins, sump pumps, roof leaders, land and basement drains, and defective manholes and tidegates.

Influent - the flow of water that enters the wastewater treatment process.

Interceptors - the large pipes that convey wastewater from the collection system to the treatment plant.

Land Application - the use of wastewater treatment residuals on land for agricultural benefits.

Landfilling - the disposal of residuals by burial. Modern landfills have double liners, leachate collection systems, and other design features to protect against groundwater contamination.

LCR - Lead and Copper Rule - This rule sets an action level for lead and copper at the "worst case" consumer tap. Optimized corrosion control, notification, education and lead service replacements are all components of compliance plan.

Leachate - water that drains from a landfill after having been in contact with, and potentially contaminated by, buried residuals. Modern landfills are designed to collect leachate for subsequent treatment.

Limnology - the scientific study of physical, chemical, meteorological, and biological conditions in fresh waters.

Mapping Protocols - sets of specifications defining the content and format of data to be collected.

MCL - Maximum Contaminant Level -the highest level of a contaminant that is allowed in drinking water.

MCLG - Maximum Contaminant Level Goal -the level of a contaminant in drinking water below which there is no known or expected risk to health.

MDC (Metropolitan District Commission) - prior to 1985, the agency responsible for water and sewer services in metropolitan Boston, a responsibility the MWRA assumed in July 1985. The MDC continues to oversee and manage parks and recreational areas, roadways in the metropolitan area, and the Quabbin Reservoir.

MEPA (Massachusetts Environmental Policy Act) - the MEPA Unit is the state office that oversees the EIR process.

Methane - a colorless, nonpoisonous, flammable gas produced as a byproduct of anaerobic sludge processing.

MGD - Million Gallons per Day

Mitigation - includes: (a) avoiding the impact altogether by not taking a certain action, (b) minimizing impacts by limiting the magnitude of the action, © rectifying the impact by repairing, rehabilitating, or restoring the impacted area, (d) preventing an impact by preservation and maintenance operations, and (e) compensating for an impact by replacing or providing substitute resources or environments.

MWRA (Massachusetts Water Resources Authority) - an independent, regional authority responsible for providing sewer and wastewater treatment services to 43 communities in the metropolitan Boston area and water services for 45 communities in the region. Central objectives of the Authority include cleaning up Boston Harbor, constructing new wastewater treatment facilities, improving the existing infrastructure, supplying adequate amounts of pure water, and promoting water conservation.

NPDES (National Pollutant Discharge Elimination System) - a permit issued by EPA in conjunction with DEP to govern discharges into waterways.

O_3 - Chemical symbol for ozone.

Operation and Maintenance (O&M) - the organized procedure for causing a piece of equipment or a treatment plant to perform its intended function and for keeping the equipment or plant in such condition that it is able continually and reliably to perform its intended function.

Organic Matter - material containing carbon, the cornerstone of plant and animal life. It originates from domestic and industrial sources.

Outfall - the place where effluent is discharged into receiving waters.

Ozone - a strong disinfectant made from oxygen and electrical energy. Effective against *crypto sporidium*.

Pathogen - Harmful organisms, often called germs, which can cause disease. Waterborne pathogens (or the diseases they cause) include *giardia*, *crypto sporidium*, cholera, typhoid, *E. Coli,* Hepatitis A, *legionella* and MAC.

Plume - the rising discharge of treated effluent from a treatment plant outfall pipe.

Pretreatment- reduction or elimination of pollutant properties in wastewater prior to discharging the wastewater into a sewer system.

Primacy - Primary enforcement authority for federal SDWA regulations delegated to a state by EPA.

Privatization - the use of private contractors to perform tasks that customarily are the responsibility of government agencies.

Preliminary Treatment - the process of removing large solid objects, sticks, gravel, and grit from wastewater.

Primary Treatment - wastewater treatment afforded by sedimentation. It results in 50-60% removal of suspended solids and 30-34% removal of BOD.

Pumping Station - mechanical devices installed to push the sewage to a higher elevation.

Residuals - the by-products of the sewage treatment process, including scum (floatables), grit and screenings, primary sludge, and secondary sludge.

RMFP (Residuals Management Facilities Plan) - the MWRA's plan for the management of all residuals generated at wastewater treatment facilities in the MWRA service area.

Relief Sewer - a sewer built to carry the flows in excess of the capacity of an existing sewer.

Remote Headworks - the initial structures and devices of a treatment plant set apart by some distance from the plant site.

Safe Yield Model - the equation used to determine the maximum dependable draft that can be made continuously on a source of supply during a period of years during which the probable driest period or period of greatest deficiency in water supply is likely to occur.

Sanitary Sewers - in a separate system, pipes that carry only domestic wastewater.

Screenings - large items, such as wood and rags, that are collected from wastewater in coarse screens prior to primary treatment.

Scum - floatable materials such as grease, oil, and plastics that are skimmed from the surface of wastewater as it flows through large settling tanks.

SDWA - Safe Drinking Water Act - Most recently amended in 1996.

Secondary Treatment - usually follows primary treatment. It employs microorganisms to further reduce the level of BOD in wastewater. Together, primary and secondary treatment result in an 85% reduction of both BOD and suspended solids.

Sedimentation Tanks - settling tanks which facilitate the removal of solids from sewage. The wastewater is pumped to the tanks where the solids settle to the bottom or float on the top as scum. The scum is skimmed off the top, and solids on the bottom are pumped out for further treatment and/or final disposal.

Sensitive user - Member of groups within the general population, such as infants, children, pregnant women, the elderly, individuals with a history of serious illness, or other subpopulations that are identified as likely to be at greater risk of adverse health effects due to exposure to contaminants in drinking water than the general population.

Septic Tanks - used for domestic wastes when a sewer line is not available to carry them to a treatment plant. Periodically, the septage is pumped out of the tanks, usually by commercial firms, and released into a wastewater treatment system.

Sewer Jet Truck - vehicle used to clean and/or remove blockages from sewer lines by pushing fluids in the sewer.

Shotcrete - mortar or concrete conveyed through a hose and projected at high velocity onto a surface; also known as air-blown mortar, pneumatically applied sprayed mortar, or gunned concrete.

Siphon - a closed conduit, a portion of which lies above the hydraulic grade line, resulting in a pressure less than atmospheric and requiring a vacuum within the conduit to start flow. A siphon utilizes atmospheric pressure to effect or increase the flow of water through the conduit.

Slip Lining - insertion by pushing or pulling of lines fabricated of plastic, concrete cylinder pipe, reinforced concrete, or steel through existing conduits from access pits.

Sludge - material removed by sedimentation during primary and secondary treatment. It includes both settled particulate matter and microorganisms and is the single largest component of wastewater residuals. At the time sludge is removed during the treatment process, it contains only .5% to 5% solid content by weight. It has the appearance of muddy water.

Sodium Hypochlorite (NaOCl) - primary chemical used in the disinfection and odor processes at the Deer Island Treatment Plant.

STFP - Secondary Treatment Facilities Plan, also known as the Deer Island Facilities Plan (see DIFP).

Storm Sewers - separate systems of pipes that carry only water runoffs from roofs, streets, and parking lots during storms.

Surcharging - loads on a system beyond those normally anticipated; the height of wastewater in a sewer manhole above the crown of the sewer when the sewer is flowing completely full.

Suspended Solids - the particulate matter contained in wastewater.

SWTR - Surface Water Treatment Rule - This rule affects all utilities using surface waters or waters under the influence of surface water. It requires filtration unless certain criteria on source water quality, watershed control and disinfection effectiveness can be met.

TCR - Total Coliform Rule - This rule requires monitoring of community distribution systems for coliform bacteria and chlorine residual. No more than 5% of the coliform samples in a month can be positive.

Telemetry - remote measuring or monitoring devices connected to a central monitoring station via telephone lines.

TOC - Total Organic Carbon - a measure of the amount of organic material in water. Often used a surrogate of disinfectant demand or DBP precursors.

Transition - a short section of conduit used as a conversion section to unite two conduits having different hydraulic elements.

TTHM - -Total Trihalomethanes - a class of disinfection byproducts, primarily of chlorine.

Underdrain Outlets - outlets from a drain that carry away groundwater or the drainage from prepared beds to which water or wastewater has been applied.

United States Geological Survey (USGS) - agency which collects Geographic Information System (GIS) data for developing mapping protocols.

Vactor Jet Truck - vehicle used to clean and/or remove blockages from sewer lines by pushing and/or pulling fluids in the sewer.

Wastewater - the water carried by sewers serving residences and businesses that enters wastewater facilities for treatment.

Wastewater Treatment Plan (WTP) - a series of tanks, screens, filters, and other equipment and processes for removing pollutants from wastewater.

APPENDIX D
CITY, TOWN/PROJECT

City or Town Project Number / Project	
All MWRA Customers	
930	North Maintenance Facility
922	Fore River Staging Area
925	Technical Assistance Contracts
931	Business Systems Plan
All Wastewater Customers	
130	Siphon Chamber & Diversion Structure Rehab.
132	Corrosion and Odor Control Study
133	Wastewater Facilities Rehabilitation
137	Wastewater Central Monitoring
182	Deer Island Treatment Plant and Related Projects
	DI As-Needed Design/CS/RI
	DI Construction Services Contracts
201	On-Site Generation of Sodium Hypochlorite
202	DI Coastal Protection
203	DI Plant-Wide Systems
261	Residuals Management Facilities
128	Infiltration/Inflow Local Financial Assistance Program
205	DI Maintenance and Storage
206	DI Equipment Replacement Program
207	DI Demineralization System for Power Plant
269	Pelletizing Plant Natural Gas Pipeline
270	Pelletizing Plant Cogeneration Facility
	CSCs/Ancillary Modifications
138	Sewerage System Mapping Upgrade
All Water Customers	
599	Dam Control Valve Replacement
601	Sluice Gate Rehabilitation
597	Winsor Dam Hydroelectric
677	Valve Replacement
712	Cathodic Protection of Distribution Mains
753	Central Monitoring System
758	Rehabilitation of Existing Facilities
763	Distribution Systems Facilities Mapping
764	Local Water Infrastructure Rehab Assistance Prog.
725	Hydraulic Model Update
All Water Customers (Except South Hadley, Chicopee, Wilbraham, Worcester, Clinton, and Leominster	
	MetroWest Tunnel
	Walnut Hill Treatment Plant
Arlington	
101	Wastewater Metering System Upgrade
179	Remote Headworks Rehabilitation
544	Norumbega Covered Storage
614	Metropolitan Tunnel Loop
704	Rehabilitation of Other Pump Stations
713	Spot Pond Supply Mains
702	New Connecting Mains - Shaft 7 to WASM 3
708	Northern Extra High Service - New Pipeline
Ashland	
107	Framingham Extension Relief Sewer
101	Wastewater Metering System Upgrade
134	Ashland Extension Sewer
136	West Roxbury Tunnel
Bedford	
544	Norumbega Covered Storage
614	Metropolitan Tunnel Loop
704	Rehabilitation of Other Pump Stations
702	New Connecting Mains - Shaft 7 to WASM 3
179	Remote Headworks Rehabilitation
708	Northern Extra High Service - New Pipeline

City or Town Project Number / Project	
Belmont	
179	Remote Headworks Rehabilitation
544	Norumbega Covered Storage
614	New Connecting Mains - Shaft 7 to WASM 5
704	Metropolitan Tunnel Loop
702	Rehabilitation of Other Pump Stations
Boston	
136	West Roxbury Tunnel
179	Remote Headworks Rehabilitation
	Combined Sewer Overflow Control Program
544	Norumbega Covered Storage
545	Blue Hills Covered Storage
614	Metropolitan Tunnel Loop
678	Boston Low Service Pipe and Valve Rehab.
718	WASM 1 and 2 Rehabilitation
679	Nonantum Road Pipe Rehabilitation
720	Warren Cottage Line Rehabilitation
681	Southern Service Improvements
683	Heath Hill Pipe Replacement
721	Southern Spine Distribution Mains
714	Southern Extra High - Sections 41 and 42
719	Chestnut Hill Connecting Mains
704	Rehabilitation of Other Pump Stations
703	WASM 4
713	Spot Pond Supply Mains
702	New Connecting Mains - Shaft 7 to WASM 3
139	Archdale Road Diversion Structure
549	Bellevue Additional Storage
Braintree	
104	Braintree-Weymouth Relief Facilities
101	Wastewater Metering System Upgrade
Brighton	
544	Norumbega Covered Storage
614	Metropolitan Tunnel Loop
Brookline	
131	Upper Neponset Valley Relief Sewer
101	Wastewater Metering System Upgrade
136	West Roxbury Tunnel
179	Remote Headworks Rehabilitation
678	Boston Low Service Pipe and Valve Rehab.
720	Warren Cottage Line
681	Southern Service Improvements
683	Heath Hill Pipe Replacement
721	Southern Spine Distribution Mains
714	Southern Extra High - Sections 41 and 43
719	Chestnut Hill Connecting Mains
704	Rehabilitation of Other Pump Stations
Burlington	
127	Cummingsville Replacement Sewer
179	Remote Headworks Rehabilitation

APPENDIX D
CITY, TOWN/PROJECT

City or Town Project Number / Project	
Cambridge	
135	System Master Plan Interceptors
179	Remote Headworks Rehabilitation
	Combined Sewer Overflow Control Program
544	Norumbega Covered Storage
614	Metropolitan Tunnel Loop
718	WASM 1 and 2 Rehabilitation
679	Nonantum Road Pipe Rehabilitation
703	WASM 4
713	Spot Pond Supply Mains
550	Low Service Storage Near Spot Pond
Canton	
105	New Neponset Valley Relief Sewer
101	Wastewater Metering System Upgrade
545	Blue Hills Covered Storage
681	Southern Service Improvements
721	Southern Spine Distribution Mains
714	Southern Extra High - Sections 41 and 44
704	Rehabilitation of Other Pump Stations
549	Bellevue Additional Storage
Charlestown	
550	Low Service Storage Near Spot Pond
Chelsea	
129	N. Metro. Trunk Sewer Rehab. Phase II
101	Wastewater Metering System Upgrade
135	System Master Plan Interceptors
179	Remote Headworks Rehabilitation
	Combined Sewer Overflow Control Program
718	WASM 1 and 2 Rehabilitation
713	Spot Pond Supply Mains
690	Northern Low Service Pipeline Replacement
690	Northern Low Service Rehabilitation - Sections 8 & 57
550	Low Service Storage Near Spot Pond
Chestnut Hill	
544	Norumbega Covered Storage
614	Metropolitan Tunnel Loop
Chicopee	
548	Nash Hill Covered Storage
543	Quabbin Treatment Plant
615	Chicopee Valley Aqueduct Interconnections
Dedham	
105	New Neponset Valley Relief Sewer
131	Upper Neponset Valley Relief Sewer
106	Wellesley Extension Sewer Replacement
135	System Master Plan Interceptors
136	West Roxbury Tunnel
East Boston	
129	N. Metro. Trunk Sewer Rehab. Phase II
716	Water Main Relocation in Chelsea River
703	Northern Low Service Rehabilitation - Sections 8 & 57
693	Northern High Service Pipe Impts - Revere/Malden
724	Northern High Service Pipeline Rehabilitation
550	Low Service Storage Near Spot Pond

City or Town Project Number / Project	
Everett	
135	System Master Plan Interceptors
179	Remote Headworks Rehabilitation
718	WASM 1 and 2 Rehabilitation
713	Spot Pond Supply Mains
690	Northern Low Service Pipeline Replacement
723	Northern Low Service Rehabilitation - Sections 8 & 57
724	Northern High Service Pipeline Rehabilitation
550	Low Service Storage Near Spot Pond
Framingham	
107	Framingham Extension Relief Sewer
136	West Roxbury Tunnel
541	Watershed Protection
Hingham	
104	Braintree-Weymouth Relief Facilities
Holbrook	
104	Braintree-Weymouth Relief Facilities
Hyde Park	
105	New Neponset Valley Relief Sewer
Lexington	
179	Remote Headworks Rehabilitation
544	Norumbega Covered Storage
614	Northern Extra High Service - New Pipeline
704	New Connecting Mains - Shaft 7 to WASM 7
702	Rehabilitation of Other Pump Stations
708	Metropolitan Tunnel Loop
Logan Airport	
716	Water Main Relocation in Chelsea River
Lynn	
689	Spot Pond Pump Station Rehabilitation
706	Northern High Service Connecting Mains to Sec. 91
691	Northern High Service Pipe Impts - Lynn Pipeline
692	Northern High Service Section 27
693	Northern High Service Pipe Impts - Revere/Malden
724	Northern High Service Pipeline Rehabilitation
Lynnfield	
689	Spot Pond Pump Station Rehabilitation
706	Northern High Service Connecting Mains to Sec. 92
Malden	
101	Wastewater Metering System Upgrade
135	System Master Plan Interceptors
179	Remote Headworks Rehabilitation
544	Norumbega Covered Storage
547	Fells Covered Storage
614	Metropolitan Tunnel Loop
718	WASM 1 and 2 Rehabilitation
689	Spot Pond Pump Station Rehabilitation
713	Spot Pond Supply Mains
723	Northern Low Service Rehabilitation - Sections 8 & 57
693	Northern High Service Pipe Impts - Revere/Malden
550	Low Service Storage Near Spot Pond

APPENDIX D
CITY, TOWN/PROJECT

City or Town	Project Number / Project
Marblehead	
689	Spot Pond Pump Station Rehabilitation
706	Northern High Service Connecting Mains to Sec. 91
691	Northern High Service Pipe Impts - Lynn Pipeline
692	Northern High Service Section 27
693	Northern High Service Pipe Impts - Revere/Malden
724	Northern High Service Pipeline Rehabilitation
Marlborough	Watershed Protection
Medford	
101	Wastewater Metering System Upgrade
179	Remote Headworks Rehabilitation
544	Norumbega Covered Storage
547	Fells Covered Storage
614	Metropolitan Tunnel Loop
718	WASM 1 and 2 Rehabilitation
689	Spot Pond Pump Station Rehabilitation
713	Spot Pond Supply Mains
690	Northern Low Service Pipeline Replacement
723	Northern Low Service Rehabilitation - Sections 8 & 57
702	New Connecting Mains - Shaft 7 to WASM 8
550	Low Service Storage Near Spot Pond
Melrose	
179	Remote Headworks Rehabilitation
547	Fells Covered Storage
689	Spot Pond Pump Station Rehabilitation
Milton	
105	New Neponset Valley Relief Sewer
101	Wastewater Metering System Upgrade
179	Remote Headworks Rehabilitation
545	Blue Hills Covered Storage
681	Southern Service Improvements
721	Southern Spine Distribution Mains
714	Southern Extra High - Sections 41 and 45
704	Rehabilitation of Other Pump Stations
549	Bellevue Additional Storage
Nahant	
689	Spot Pond Pump Station Rehabilitation
706	Northern High Service Connecting Mains to Sec. 91
691	Northern High Service Pipe Impts - Lynn Pipeline
692	Northern High Service Section 27
693	Northern High Service Pipe Impts - Revere/Malden
724	Northern High Service Pipeline Rehabilitation
Natick	
107	Framingham Extension Relief Sewer
101	Wastewater Metering System Upgrade
136	West Roxbury Tunnel
Needham	
106	Wellesley Extension Sewer Replacement
136	West Roxbury Tunnel
Newton	
131	Upper Neponset Valley Relief Sewer
179	Remote Headworks Rehabilitation
679	Nonantum Road Pipe Rehabilitation
719	Chestnut Hill Connecting Mains
715	Newton Service Improvements
684	Commonwealth Ave. Pump Station Modernization
703	WASM 4
702	New Connecting Mains - Shaft 7 to WASM 3
549	Bellevue Additional Storage

City or Town	Project Number / Project
Norwood	
105	New Neponset Valley Relief Sewer
545	Blue Hills Covered Storage
681	Southern Service Improvements
721	Southern Spine Distribution Mains
714	Southern Extra High - Sections 41 and 42
704	Rehabilitation of Other Pump Stations
549	Bellevue Additional Storage
Peabody	
689	Spot Pond Pump Station Rehabilitation
691	Northern High Service Pipe Impts - Lynn Pipeline
692	Northern High Service Section 27
693	Northern High Service Pipe Impts - Revere/Malden
Quincy	
102	Quincy Pump Facilities
104	Braintree-Weymouth Relief Facilities
545	Blue Hills Covered Storage
681	Southern Service Improvements
721	Southern Spine Distribution Mains
Randolph	
104	Braintree-Weymouth Relief Facilities
Reading	
179	Remote Headworks Rehabilitation
Revere	
129	N. Metro. Trunk Sewer Rehab. Phase II
135	System Master Plan Interceptors
179	Remote Headworks Rehabilitation
718	WASM 1 and 2 Rehabilitation
706	Northern High Service Connecting Mains to Sec. 91
693	Northern High Service Pipe Impts - Revere/Malden
724	Northern High Service Pipeline Rehabilitation
Saugus	
547	Fells Covered Storage
689	Spot Pond Pump Station Rehabilitation
706	Northern High Service Connecting Mains to Sec. 91
691	Northern High Service Pipe Impts - Lynn Pipeline
693	Northern High Service Pipe Impts - Revere/Malden
724	Northern High Service Pipeline Rehabilitation
Somerville	
101	Wastewater Metering System Upgrade
135	System Master Plan Interceptors
179	Remote Headworks Rehabilitation
	Combined Sewer Overflow Control Program
544	Norumbega Covered Storage
614	Metropolitan Tunnel Loop
718	WASM 1 and 2 Rehabilitation
713	Spot Pond Supply Mains
702	New Connecting Mains - Shaft 7 to WASM 3
550	Low Service Storage Near Spot Pond
South Hadley	
548	Nash Hill Covered Storage
543	Quabbin Treatment Plant
615	Chicopee Valley Aqueduct Interconnections
Southborough	
541	Watershed Protection

APPENDIX D
CITY, TOWN/PROJECT

City or Town	Project Number / Project
Stoneham	
179	Remote Headworks Rehabilitation
546	Bear Hill Covered Storage
547	Fells Covered Storage
722	Bear Hill Improvements - Section 29 Rehabilitation
689	Spot Pond Pump Station Rehabilitation
Stoughton	
105	New Neponset Valley Relief Sewer
Swampscott	
689	Spot Pond Pump Station Rehabilitation
706	Northern High Service Connecting Mains to Sec. 91
691	Northern High Service Pipe Impts - Lynn Pipeline
692	Northern High Service Section 27
Wakefield	
179	Remote Headworks Rehabilitation
546	Bear Hill Covered Storage
547	Fells Covered Storage
722	Bear Hill Improvements - Section 29 Rehabilitation
689	Spot Pond Pump Station Rehabilitation
Walpole	
105	New Neponset Valley Relief Sewer
Waltham	
179	Remote Headworks Rehabilitation
544	Norumbega Covered Storage
614	Metropolitan Tunnel Loop
687	Lexington St. Pump Station Rehabilitation
704	Rehabilitation of Other Pump Stations
702	New Connecting Mains - Shaft 7 to WASM 3
708	Northern Extra High Service - New Pipeline
Watertown	
179	Remote Headworks Rehabilitation
544	Norumbega Covered Storage
614	Metropolitan Tunnel Loop
679	Nonantum Road Pipe Rehabilitation
704	Rehabilitation of Other Pump Stations
703	WASM 4
702	New Connecting Mains - Shaft 7 to WASM 3
Wellesley	
106	Wellesley Extension Sewer Replacement
101	Wastewater Metering System Upgrade
136	West Roxbury Tunnel
West Roxbury	
131	Upper Neponset Valley Relief Sewer
Weston	
544	Norumbega Covered Storage
614	Metropolitan Tunnel Loop
Westwood	
105	New Neponset Valley Relief Sewer
Weymouth	
104	Braintree-Weymouth Relief Facilities

City or Town	Project Number / Project
Wilbraham	
548	Nash Hill Covered Storage
543	Quabbin Treatment Plant
615	Chicopee Valley Aqueduct Interconnections
Wilmington	
179	Remote Headworks Rehabilitation
Winchester	
127	Cummingsville Replacement Sewer
101	Wastewater Metering System Upgrade
135	System Master Plan Interceptors
179	Remote Headworks Rehabilitation
544	Norumbega Covered Storage
546	Bear Hill Covered Storage
614	Metropolitan Tunnel Loop
704	Rehabilitation of Other Pump Stations
722	Bear Hill Improvements - Section 29 Rehabilitation
689	Spot Pond Pump Station Rehabilitation
702	New Connecting Mains - Shaft 7 to WASM 13
Winthrop	
129	N. Metro. Trunk Sewer Rehab. Phase II
101	Wastewater Metering System Upgrade
179	Remote Headworks Rehabilitation
693	Northern High Service Pipe Impts - Revere/Malden
724	Northern High Service Pipeline Rehabilitation
Woburn	
127	Cummingsville Replacement Sewer
135	System Master Plan Interceptors
179	Remote Headworks Rehabilitation
546	Bear Hill Covered Storage
722	Bear Hill Improvements - Section 29 Rehabilitation
689	Spot Pond Pump Station Rehabilitation

APPENDIX E
PROJECT/CITY, TOWN

Project Number / Project	Community(s) Affected
102 Quincy Pump Facilities	Quincy
104 Braintree-Weymouth Relief Facilities	Braintree Hingham Holbrook Randolph Weymouth Quincy
105 New Neponset Valley Relief Sewer	Canton Dedham Hyde Park Milton Norwood Stoughton Walpole Westwood
131 Upper Neponset Valley Relief Sewer	Brookline Dedham Newton West Roxbury
106 Wellesley Extension Sewer Replacement	Dedham Needham Wellesley
107 Framingham Extension Relief Sewer	Ashland Framingham Natick
127 Cummingsville Replacement Sewer	Burlington Winchester Woburn
129 N. Metro. Trunk Sewer Rehab. Phase II	Chelsea East Boston Revere Winthrop
130 Siphon Chamber & Diversion Structure Rehab.	All Wastewater Customers
101 Wastewater Metering System Upgrade	Arlington Ashland Braintree Brookline Canton Chelsea Malden Medford Milton Natick Somerville Wellesley Winchester Winthrop
134 Ashland Extension Sewer	Ashland

Project Number / Project	Community(s) Affected
135 System Master Plan Interceptors	Cambridge Chelsea Dedham Everett Malden Revere Somerville Woburn Winchester
132 Corrosion and Odor Control Study	All Wastewater Customers
133 Wastewater Facilities Rehabilitation	All Wastewater Customers
136 West Roxbury Tunnel	Ashland Boston Brookline Dedham Framingham Natick Needham Wellesley
137 Wastewater Central Monitoring	All Wastewater Customers
179 Remote Headworks Rehabilitation	Arlington Bedford Belmont Boston Brookline Burlington Cambridge Chelsea Everett Lexington Malden Medford Melrose Milton Newton Reading Revere Somerville Stoneham Wakefield Waltham Watertown Wilmington Winchester Winthrop Woburn
182 Deer Island Treatment Plant and Related Projects	All Wastewater Customers
200 CSCs/Ancillary Modifications	All Wastewater Customers
DI Construction Services Contracts	All Wastewater Customers
201 On-Site Generation of Sodium Hypochlorite	All Wastewater Customers
202 DI Coastal Protection	All Wastewater Customers

APPENDIX E
PROJECT/CITY, TOWN

Project Number / Project	Community(s) Affected
203 DI Plant-Wide Systems	All Wastewater Customers
205 DI Maintenance and Storage	All Wastewater Customers
206 DI Equipment Replacement Program	All Wastewater Customers
207 DI Demineralization System for Power Plant	All Wastewater Customers
261 Residuals Management Facilities	All Wastewater Customers
Combined Sewer Overflow Control Program	Boston Cambridge Chelsea Somerville
128 Infiltration/Inflow Local Financial Assistance Program	All Wastewater Customers
542 Walnut Hill Treatment Plant	All Water Customers (Except South Hadley, Chicopee, Wilbraham, Worcester, Clinton, and Leominster.)
543 Quabbin Treatment Plant	South Hadley Chicopee Wilbraham
541 Watershed Protection	Southborough Marlborough Framingham
544 Norumbega Covered Storage	Arlington Bedford Belmont Boston Brighton Cambridge Chestnut Hill Lexington Malden Medford Somerville Waltham Watertown Weston Winchester
548 Nash Hill Covered Storage	Chicopee South Hadley Wilbraham
545 Blue Hills Covered Storage	Quincy Milton Boston Canton Norwood
546 Bear Hill Covered Storage	Stoneham Wakefield Winchester Woburn
547 Fells Covered Storage	Stoneham Wakefield Melrose Saugus Malden Medford

Project Number / Project	Community(s) Affected
604 MetroWest Tunnel	All Water Customers (Except South Hadley, Chicopee, Wilbraham, Worcester, Clinton, and Leominster)
599 Dam Control Valve Replacement	All Water Customers
601 Sluice Gate Rehabilitation	All Water Customers
614 Metropolitan Tunnel Loop	Arlington Bedford Belmont Boston Brighton Cambridge Chestnut Hill Lexington Malden Medford Somerville Waltham Watertown Weston Winchester
615 Chicopee Valley Aqueduct Interconnections	Chicopee Wilbraham South Hadley Fire District
597 Winsor Dam Hydroelectric	All Water Customers
677 Valve Replacement	All Water Customers
712 Cathodic Protection of Distribution Mains	All Water Customers
678 Boston Low Service Pipe and Valve Rehab.	Boston Brookline
718 WASM 1 and 2 Rehabilitation	Boston Cambridge Chelsea Everett Malden Medford Revere Somerville
679 Nonantum Road Pipe Rehabilitation	Boston Cambridge Newton Watertown *Also improves pressure to the Northern High Service area in addition to source supply to all communities served by the Spot Pond Supply Mains
720 Warren Cottage Line Rehabilitation	Boston Brookline
681 Southern Service Improvements	Boston Brookline Canton Milton Norwood Quincy
683 Heath Hill Pipe Replacement	Boston Brookline

APPENDIX E
PROJECT/CITY, TOWN

Project Number / Project	Community(s) Affected
721 Southern Spine Distribution Mains	Boston Brookline Milton Quincy Norwood Canton
714 Southern Extra High - Sections 41 and 42	Boston Brookline Canton Milton Norwood
719 Chestnut Hill Connecting Mains	Boston Brookline Newton
715 Newton Service Improvements	Newton
684 Commonwealth Ave. Pump Station Modernization	Newton
687 Lexington St. Pump Station Rehabilitation	Waltham
704 Rehabilitation of Other Pump Stations	Arlington Bedford Belmont Boston Brookline Canton Lexington Milton Norwood Waltham Watertown Winchester
722 Bear Hill Improvements - Section 29 Rehabilitation	Stoneham Wakefield Winchester Woburn
689 Spot Pond Pump Station Rehabilitation	Lynn Lynnfield Malden Marblehead Medford Melrose Nahant Peabody Saugus Stoneham Swampscott Wakefield Winchester Woburn
703 WASM 4	Boston Cambridge Newton Watertown *Also improves pressure to the Northern High Service area in addition to source supply to all communities served by the Spot Pond Supply Mains
713 Spot Pond Supply Mains	Arlington Boston Cambridge Chelsea Everett Malden Medford Somerville

Project Number / Project	Community(s) Affected
690 Northern Low Service Pipeline Replacement	Everett Medford Chelsea
716 Water Main Relocation in Chelsea River	East Boston Logan Airport
723 Northern Low Service Rehab. - Sections 8 & 57	Chelsea East Boston Everett Malden Medford
702 New Connecting Mains - Shaft 7 to WASM 3	Arlington Bedford Belmont Boston Lexington Medford Newton Somerville Waltham Watertown Winchester
707 Northern High Service - Section 26 Revere	Lynn Revere Saugus
706 Northern High Service Connecting Mains to Sec. 91	Lynn Lynnfield Marblehead Nahant Revere Saugus Swampscott
691 Northern High Service Pipe Impts - Lynn Pipeline	Lynn Marblehead Nahant Peabody Saugus Swampscott
692 Northern High Service Section 27	Lynn Marblehead Nahant Peabody Swampscott
693 Northern High Service Pipe Impts - Revere/Malden	East Boston Lynn Malden Marblehead Nahant Peabody Revere Saugus Winthrop
724 Northern High Service Pipeline Rehabilitation	East Boston Everett Lynn Marblehead Nahant Revere Saugus Winthrop
708 Northern Extra High Service - New Pipelines	Arlington Bedford Lexington Waltham
753 Central Monitoring System	All Water Customers

APPENDIX E
PROJECT/CITY, TOWN

Project Number / Project		Community(s) Affected
758	Rehabilitation of Existing Facilities	All Water Customers
763	Distribution Systems Facilities Mapping	All Water Customers
764	Local Water Infrastructure Rehab Assistance Prog.	All Water Customers
930	North Maintenance Facility	All MWRA Customers
922	Fore River Staging Area	All MWRA Customers
925	Technical Assistance Contracts	All MWRA Customers
931	Business Systems Plan	All MWRA Customers

Appendix F

Water Quality/Distribution Capital Initiative;Applicable State and Federal Requirements

The Surface Water Treatment Rule (SWTR), promulgated by the U.S. Environmental Protection Agency (EPA) in 1989, specifies the conditions under which filtration of surface water supplies is required and mandates the use of more potent disinfection techniques. Since 1977, existing state regulations have dictated that once water has received final treatment, all downstream storage must be in enclosed facilities to preserve quality. The Lead and Copper Rule, promulgated in 1991, requires treatment actions to reduce the water's corrosivity if excessive levels of lead or copper are detected at consumers' taps. The EPA issued the Disinfectants and Disinfection By-Products Rule (D/DBP Rule) and the Enhanced Surface Water Treatment Rule (ESWTR) in draft form in July 1994. The D/DBP (Stage I) Rule is scheduled for promulgation in November 1998. The D/DBP Rule will limit the concentration of certain chemicals of concern which form when water is disinfected.

U.S. EPA, in the proposed ESWTR, is considering revisions to the Surface Water Treatment Rule which would require that surface water systems remove microbiological contaminants above levels currently required by the SWTR. In addition, EPA is considering requiring surface water systems to treat for *Cryptosporidium*. ESWTR is scheduled to be promulgated several years after the D/DBP Rule (Stage 1). An Interim ESWTR is scheduled for promulgation at the same time as D/DBP Rule (Stage 1).

The Information Collection Rule (ICR), promulgated in 1996, requires surface water systems beginning in 1997 to collect additional data on occurrence, treatment, and characterization of disinfectants, disinfection by-products, and microorganisms. EPA will use the data assembled from sources across the country to set enforceable limits for various disinfectant and disinfection by-products and microorganisms in the D/DBP Rule (Stage 1) and Interim ESWTR, and ultimately, in the D/DBP Rule (Stage II) and ESWTR. In anticipation of the Information Collection Rule, MWRA began collecting various water quality data in 1994.

From prior MWRA studies, it is known that the watersheds around the sources must be better protected, disinfection and corrosion control facilities must be modified and upgraded, and the use of open distribution reservoirs must be phased out. In conjunction with the Metropolitan District Commission, MWRA has increased watershed protection efforts across the Quabbin/Ware/Wachusett System. Disinfection and corrosion control facilities have been upgraded and a new treatment plant for Wachusett will be under construction in early 1999. Covered storage facilities are under construction and open storage will be removed by late 2003.

The Massachusetts Department of Environmental Protection (DEP) is responsible for administering and enforcing drinking water quality standards in the Commonwealth.

MWRA intends to continue working with DEP and EPA to implement a drinking water quality improvement program which utilizes a cost effective and reliable approach to satisfying the law.

Consent Order Terms

In 1990, DEP promulgated the state's version of the Surface Water Treatment Rule and issued guidelines on the application process for a filtration waiver. Below is a summary on the status of compliance for each reservoir.

Quabbin Reservoir

Quabbin Reservoir is currently the sole source of water to the three Chicopee Valley Aqueduct communities and provides about 50% of water flowing through Wachusett to metropolitan Boston. DEP has granted a conditional waiver from filtration for Quabbin Reservoir water. A Consent Order covering activities to support the continuation of the filtration waiver was signed in December 1991. The consent order schedule for design and construction of permanent disinfection facilities, which are needed to comply with the federal and state drinking water standards, was submitted to DEP in February 1994. The approved treatment process for disinfection is chlorination for primary disinfection, and chloramination for residual disinfection. The publication of new draft regulations for the Enhanced Surface Water Treatment Rule and Disinfectant/Disinfection By-Products Rule, and discussions regarding a possible *Cryptosporidium* rule have raised questions regarding the long-term efficacy of this treatment technology.

An action plan has been developed to account for the possibility of future treatment requirements. A life cycle cost analysis found that the chlorine/chloramine option is the most cost-effective, even if additional treatment is required as soon as two years later. Ozonation facilities or other treatment processes may be ultimately required. Also required by this consent order was the removal of the open Nash Hill Reservoir from service by April 2000. A new covered storage facility is now under construction at Nash Hill.

Wachusett Reservoir

MWRA initially intended to seek a filtration waiver for Wachusett Reservoir. The effort was suspended in January 1991, however, after several months of testing indicated that total and fecal coliform levels in the reservoir exceeded the limit for avoiding filtration. Subsequently, in January 1992, the DEP issued a determination that filtration would be required for Wachusett Reservoir. During negotiation of the DEP Consent Order to enforce the SWTR, MWRA was successful in securing terms which would provide additional flexibility relative to the Wachusett Reservoir filtration requirement. On June 11, 1993, the MWRA, MDC, and DEP signed a Consent Order which outlines the obligations for compliance with the SWTR under a dual track approach. There have been amendments to the Consent Order in 1995, 1997 and 1998.

The filtration track requires MWRA to continue preparations for constructing a filtration facility by December 2003. Final designs for filtration and disinfection facilities must be completed by November 1998. The non-filtration track allows MWRA and the MDC to take actions which may enable the Wachusett Reservoir to meet the criteria for a filtration waiver prior to the start of

construction of a water treatment facility, reducing its cost significantly. A decision on the type of treatment facility to build is planned for October 1998.

The non-filtration track stipulates that a Watershed Protection Plan be formally submitted to DEP by September 1, 1993 and that it be implemented by July 31, 1998. Furthermore, source water quality improvement must be achieved, as demonstrated by meeting the coliform standard for 12 consecutive 6-month periods. Both of these requirements have been fulfilled and a draft update to the protection plan covering the next five years was submitted to DEP in July, 1998.

In early 1998, the U.S. E.P.A. filed suit against the MWRA and MDC for failing to filter the Wachusett Reservoir. A federal judge has allowed the MWRA to complete its decision making process with DEP review and approval in late 1998. Construction of facilities common to all three treatment alternatives will commence in early 1999 while any legal issues on the treatment process are resolved on a schedule designed to meet the December 2003 completion date.

The Consent Order also establishes schedules complying with covered storage requirements: construction of covered storage by December 31, 1998, at Fells Reservoir, and compliance at Norumbega Reservoir by December 31, 2003. MWRA must discontinue use of Spot Pond and Weston Reservoir by November 30, 1997, and October 2003, respectively. Spot Pond and Fells have been removed from service and the Weston and Norumbega projects are on schedule.

Watershed Protection Needs

Under the Reservoir Risk Assessment project which was completed in 1991, MWRA and MDC jointly produced watershed protection plans for each of the sources. Consistent with DEP guidelines, the plans described the physical characteristics of the watersheds, evaluated existing and potential pollution threats, and recommended measures to control those threats.

In the Wachusett Reservoir watershed, the most serious threats were judged to be failing and substandard septic systems, poor quality storm water runoff, and gull populations near the intake. Other factors of concern included the high development density near the reservoir, the low percentage of land ownership by the MDC, and the risk of a transportation accident which could cause chemical contamination of the reservoir. To address these problems MDC has carried out an aggressive protection program including measures such as acquisition of additional land parcels near tributaries, implementation and enforcement of land use restrictions, design and construction of sewers to replace septic systems in critical areas, provision of technical assistance to local communities and boards of health, and stepped-up efforts to prevent gulls from congregating near the intake. As part of this project's environmental review phase, a re-evaluation of the watershed protection plan was conducted to determine if some changes or accelerated measures could help improve the likelihood of meeting the filtration avoidance criteria. The suggested revisions have been implemented and a draft update to the Wachusett plan was completed in July 1998.

The cooperation and support of local, state, and federal agencies is essential to the success of many

watershed protection initiatives. MDC and MWRA will seek to ensure that other agencies and entities appropriately carry out their duties and responsibilities to preserve environmental quality and water resources within the watersheds. Positive actions in this regard include a joint DEP-MDC study on the impacts of storm water on a major tributary, a successful bird harassment program, an aggressive land acquisition effort, stronger DEP regulations on septic systems, and the formation of the "Wachusett Task Force" to facilitate inter-town communication and coordination on issues facing health and planning boards. The jointly funded sewering project for portions of Holden and West Boylston discussed in the Watershed Protection project is an excellent example of this effort. Other opportunities to increase participation and funding by outside agencies will be pursued.

Covered Storage

Open reservoirs within the water distribution system are considered primary water supply sources under the Safe Drinking Water Act and are therefore subject to the Surface Water Treatment Rule. State regulations require that all open distribution reservoirs be covered to prevent airborne, land, and waterborne contamination. MWRA's long-term plan is to provide approximately 400 million gallons of enclosed storage at various locations throughout the system. This quantity represents approximately one day of maximum demand.

The CIP includes storage facilities for which construction will start by 2006 and which will provide a total of 290 million gallons of storage. The existing Norumbega Reservoir is expected to be maintained to provide an additional minimum of 75 million gallons of open storage for emergency back-up. Covered storage is proposed in the following projects: a 50 million gallon clearwell at the Walnut Hill water treatment plant, 115 million gallons at Norumbega Reservoir, 25 million gallons at the Nash Hill Reservoir, 30 million gallons at Blue Hills, 20 million gallons at the Fells Reservoir, 20 million gallons at the Weston Reservoir, 20 million for low service storage, 6 million for Bear Hill, and 3.6 million for Bellevue Additional Storage.